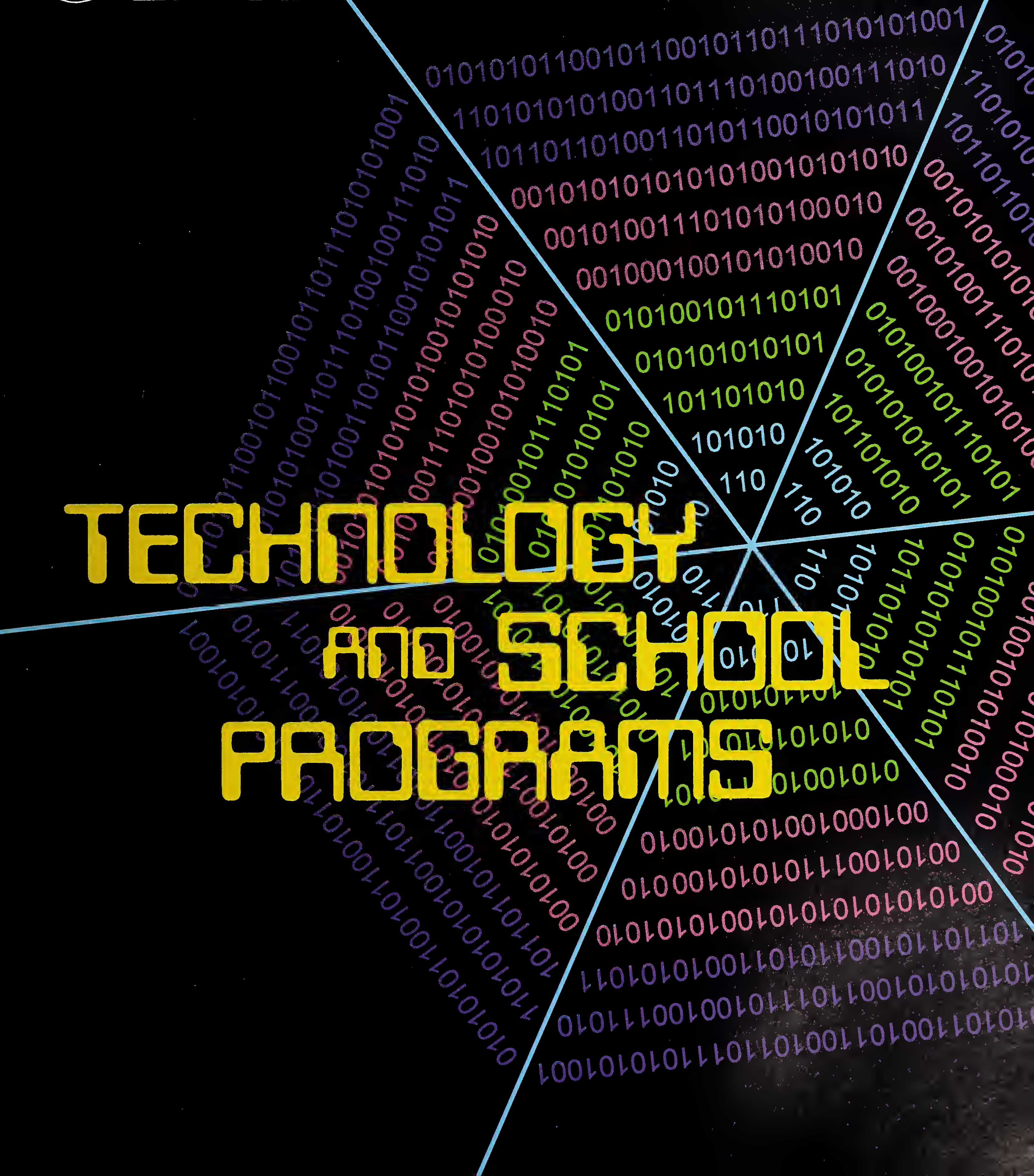
ORBIT

Ontario's Magazine for Schools
Published by OISE/UT

VOLUME 27, Number 3, 1996



TECHNOLOGY AND SCHOOL PROGRAMS

ORBIT

A publication of the Ontario Institute for Studies in Education of the University of Toronto

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GRAPHIC DESIGN: Helmut W. Weyerstrahs

TYPESETTING: Arnheim Typesetting & Design

Printed and bound in Canada
by Thistle Printing

SUBSCRIPTION RATES:
$38.52 per subscription year (4 issues). Incl. 7% GST

To order: Mail cheque or money order to

ORBIT
P.O. Box 10, Station F
Toronto, Ontario, M4Y 2L4

Phone: (416) 447-8186 Fax: (416) 447-2713

Second Class Mail Registration Number 4511
ISSN 0030-4433 03

Canadian Publications Mail Product Agreement
No. 638528

NOTES FROM THE DEAN

Education technology has arrived as a new literacy in Ontario schools. Presently school systems are working hard and creatively to integrate this technology into many aspects of their practice from the elementary to the secondary level. This issue of *Orbit* invites educators to look particularly at computing literacy as a new basic in school programs and to take advantage of many new technology-based practices.

The Guest Editors have brought together applied researchers, school administrators, and classroom teachers to share their ideas and practices in implementing innovations in the use of technology in the classroom. TVO, a leader in the field of multi-media education, has contributed extensively to this issue. The issue also includes exemplary practices from several Ontario Boards of Education, with a number of examples from Peel, and examples of learning opportunities for young people developed by researchers and consultants in museums, libraries, and the field of publishing.

Some of the leading edge classroom technology described in this issue has been developed by OISE/UT partnerships with schools and we look forward to further partnerships. The publication of this technology issue is very timely for OISE/UT as it launches the Education Commons, an enterprise which seeks to realize the benefits of closely integrating institutional information, computing, and media initiatives with research, teacher development, and graduate programs.

—*Dean* Michael Fullan

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Technology and School Programs

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Introduction

Developing this issue has been an exciting project. Although the full impact of the emerging technologies on schools is not yet clear, we are beginning to see their enormous potential benefit to the process of teaching and learning for students and teachers. There are clear links between what is being learned about multiple intelligences and learning styles and the use of multiple technologies in education. Indeed, implementation of more individualized schooling and higher levels of achievement for all students is likely not possible without the use of a wider range of technologies and partnerships in education.

Chalkboard and print, still the mainstays of education technology in so many schools, are being superseded in others by a powerful combination of computers, electronic networks, and video — a combination so different from each of its constituent parts that it comprises an entirely new educational medium. This medium is marked by an ability to individualize learning, bring vast amounts of information to the learner, enable learners to develop and communicate new learning, and draw together communities of learners far removed from one another geographically.

These changes are occurring within the context of rapid economic and social changes brought on, in part, by these same technologies — technologies that make communication across the globe instantaneous and information a highly fluid commodity. In an information age, everyone must achieve high levels of education to be able to earn a living and contribute to the well-being and continued development of society. Society needs the contribution of people of *all* the intelligences identified by Howard Gardner, not just those intelligences our schools have traditionally served best — verbal and mathematical — but visual/spatial, interpersonal, intrapersonal, musical, and kinaesthetic as well.

To prepare students for life in such a world, education must involve far more than the acquisition of traditional basic skills and information. Students must construct rather than simply acquire knowledge, skills, and values that result in the kinds of application-based learning outcomes identified in Ontario's Common Curriculum.

Ontario schools were designed to serve the information-poor society of 100 years ago. The advent of television 50 years ago began a process of change that has made this kind of school outdated. The increasing use of computers and electronic networks in recent years has hastened this process by making society even more information rich. There is now far more information available to young people outside the walls of the school than within. As yet, however, there is no coherent new vision to replace the traditional school.

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The outcomes-based approach of the Common Curriculum has the potential to change the role of schools to serve student and society more effectively in an information age. In an outcomes-based program, learning does not have to occur within the walls of a single institution. The curriculum requires schools to support learning in many contexts and to partner with a wide variety of other community organizations. Technology provides linkages that make changes of this kind feasible.

Exactly how technology will impact on schools, teaching, and learning should be considered by every principal, teacher, parent, and student as well as by educational administrators and politicians. We ask you to reflect on the following questions:

- Will our schools meet the challenge to use the emerging technologies effectively or will they become increasingly outdated and irrelevant for students and society?
- Will vast sums of money be spent equipping schools with technologies that are under-utilized because their use is not incorporated into the provincial and school curriculum or because teachers lack needed skills?
- Will technology promote equity in education by being fully available in all schools or will it support continued inequity by being available only in schools whose parents can afford to subsidize its acquisition?
- Will technology be implemented in education in ways that enhance or erode the essential human aspects of teaching and learning?
- Will adequate resources be available to develop high quality Ontario-based curriculum that fully incorporates the emerging technologies — curriculum that could be exported to underwrite the cost of providing it to our own students? Or will Ontario lose control of its own curriculum and become increasingly dependent on foreign producers?

This issue of *Orbit* explores these and other questions by sharing ideas, programs, and approaches that may someday be seen as pioneering. The introductory section explores some of the key ideas and developments that are driving the technological upgrading of schools. Section two profiles emerging school programs and initiatives that incorporate a variety of technologies in a variety of ways. Section three explores uses of technology for educational purposes for young people outside the walls of the traditional school. The fourth section focuses on the impact of technology on teachers' learning.

We hope teachers, consultants, and others in the extended educational community will join in the exploration of the perspectives, successes, and concerns about education technology which this outstanding collection of authors have presented here.

The Difference with Technology

By WAYNE SELLER

Each innovation introduced into schools and classrooms brings with it the need to consider how the implementation will proceed. Since professional development is part of the implementation, the question also arises about the inservice program required to support the implementation process. Decisions about these issues depend to a great extent on the characteristics of the innovation itself and what, if anything, makes this particular innovation unique.

Since the realization that implementation is a process and not an event, general procedures for implementation of innovations have been developed for schools and school systems. Innovations with a reasonably common set of characterisitics can then be implemented by following the general procedure, adapting specific aspects (such as topics for professional development sessions) to the innovation.

Can the introduction of technology into schools and classrooms follow this general mold?

Certainly technology entails all three basic dimensions of a significant change as described by Fullan and Park (1981): teaching resources, methodology, and beliefs. To the extent that all three dimensions need to be addressed during the planning for implementation, the introduction of technology does not differ from that of other significant changes.

In some respects, however, technology presents a different set of implementation challenges.

New textbooks or similar resources, different teaching methodologies or approaches (such as "Whole language"), or new policies (the "Common Curriculum" for example) are usually designed to be used with specific parts of the school program. In some cases, this is a specific subject or set of skills (Whole Language) while with others, a range of subjects and skills (Common Curriculum). Unlike other innovations, however, technology is ubiquitous. It potentially touches, and affects, all aspects of the curriculum. Unlike a new textbook, or teaching strategy, technology potentially spans and touches everything taught in the classroom. It is a tool, not a curriculum.

A second unique characteristic of technology as an innovation is that it is not the sole purview of education. Technology is touching the lives of every member of society in numerous ways. Adaptations to the use of technology in schools then must be consistent, to some extent at least, with what is occurring in the broader societal context. This means that there is no question about "whether" technology will be implemented — the only question is "how". Ignoring the use of technology removes schools from their role as integral components of the social fabric they are designed to serve.

Technology exhibits a third characteristics which makes it different from most other classroom innovations. A textbook, teaching methodology, or policy, once developed, tends to maintain its form for a prolonged period of time. Technology is more like an automobile — there is a new model every year (and with most technology, a new model every month). Schools are not implementing something which has known capabilities and limitations since these change, grow, and expand with each advance in any part of the whole.

These essential differences in the characteristics of technology as an innovation require that the professional development program which accompanies the implementation recognize its distinctive qualities.

As with the introduction of a new tool into any workplace, those who must use the tool need to understand the need for it. Adults have an aversion to learning how to use something if they do not know how it will make their lives easier. Once they understand how technology can lead to greater learning for their students and how it can make them more efficient and effective as teachers, then they will see the need to learn how to use the tool effectively and efficiently. In other words, providing workshops on how to run computers before the teachers appreciate what the computers can do for them is counter-productive.

Once the need is recognized, technical facility with the tools is required. Learning to use a computer makes far more sense to someone who knows what s/he wants to do with it than trying to master the skills of running a machine simply on the hope that something useful might emerge from the process. This suggests that teachers should approach the technical training with a personal plan for the classroom application of what they learn. This is a cornerstone for professional development activities introducing new teaching resources or methodologies — it is often absent in computer workshops.

A new tool requires time for experimentation and "safe practice". Both of these processes allow a person to make mistakes and find solutions to old and new problems. Safe practice involves using the innovation in a situation which does not pose potential harm to anyone. For teachers, this means not jeopardizing student success or interfering with student learning. Working out applications and trying them out with other teachers before using them in the classroom is a natural way to accomplish this.

As skills are developed with a new tool, the users need to interact with others on a regular basis to discuss problems and seek solutions, and to reflect on their own experiences. Bad habits, oversights, and omissions are more likely to be corrected as they are identified than they are after they have been embedded in practice.

Finally, regular ongoing updates are needed to ensure that teachers are aware of the evolution of the technology. While it is unlikely that they will be constantly getting state-of-the-art equipment, it is important that they remain aware of what is possible and how technology is affecting the world beyond the classroom. When the time comes for them to acquire new technological resources, they will then be in a position to make a reasoned judgment of what best serves their purposes.

The implementation and professional development needs with respect to technology in schools, then, are simultaneously the same as and different from those of any other innovations. Basic tenets of effective implementation processes and sound professional development practices apply to technology as they do to any significant change initiative. The pervasive nature of technology across the curriculum and throughout society, and its status as a tool, do make it necessary to allow for particular emphases on some of the principles.

REFERENCE

Fullan, M. & Park, P. (1981). *Curriculum implementation: A resource booklet*. Toronto: Ontario Ministry of Education.

Section 1

OVERVIEW OF THE ISSUES

What's driving the technological upgrading of schools?

✿

What is the place of technology in schools, culture, and society?

✿

Where is technology in the Common Curriculum?

✿

What role is the community playing in this innovation?

✿

Connected Intelligence in Education

From a Broadcast to a Network Medium

By DERRICK DE KERCKHOVE

Derrick de Kerckhove is Professor of French Language and Literature and Director of the McLuhan Program in Culture and Technology at the University of Toronto. A collaborator, assistant, translator, and close associate of Marshall McLuhan for over a decade, de Kerckhove is most recently best known for his work as an author. His book *The Skin of Culture*, which enjoyed longevity on the *Globe and Mail*'s National Bestseller List for a number of weeks, is now being translated into several Asian and European languages.

In February 1996, de Kerckhove spoke at *Leap Into the Future — Managing and Using the Internet*, a conference for educators sponsored by the Learning Consortium. *Orbit* thanks the Learning Consortium for providing us with the transcript for de Kerckhove's talk. Here follow edited excerpts from his keynote address.

Connected intelligence is the process and the effect of making people work together with or without the help of networked communications devices. It is a networked, not a broadcast model of communication and mental behavior.

We have in this auditorium a classic image of what I call the broadcast model of economy, technology, education, … everything. I am unfortunately an example of broadcast modeling. I am a source of a message, and it goes right to you and you are the silent recipients. By and large, the model of our educational system has been that of the broadcast model, and how one replaces it or whether one should replace it is a question that I would like to address.

One of the most interesting pedagogical controversies that I have ever experienced was when I was a kid in school. We were studying Montaigne, the French philosopher. He was criticizing the model of learning of Rabelais. Rabelais had been showing by his many novels that an educational environment needed to fill students with information and knowledge: "une tête bien pleine," — a head well filled as he called it. Montaigne on the other hand was thinking, "well all the information is out there, so why bother having it in the head when you can go and get it." So what you want to teach, said Montaigne, was "une tête bien faite," — a head well made or well organized. This question of well made versus well filled was of great interest to us as kids because we were taught to learn a lot of things we didn't like to learn, and some of them by heart. We felt it was much better if we could get to the book to put it all together in an intelligent way. So, that was the pedagogical challenge of the turn from the Middle Ages to the Renaissance. And we stayed with the Renaissance model all the way until television.

This opposition between a well-organized head versus a well-filled head points to three very important themes of today. One, is that it's a media-related pedagogical issue. There was such little access to information in the manuscript culture that you had to jam the head full of the information. The moment the knowledge was printed and thus, more evenly distributed, the multiplication of access to knowledge allowed people to liberate themselves from remembering into really thinking. And thinking made these people very much media-dependent people — the medium here being the book. That is the first issue I want to address. What has happened today to that kind of relationship between the medium and, not the message, but the head?

The second issue I want to talk about is the emphasis on the individual as stand alone. Individual as stand alone was not the normal way of the Middle Ages. People got together. The stand-alone individual, both in politics and in psychology, and very soon in religion, during the Renaissance and all the way to our own time, is the model of the Renaissance man. That character is a solitary individual and is considered and treated as such and is only related by vote or by negotiation, by talk or by some form of personally controlled communication, to the community. The stand-alone individual is also the object of our pedagogy from the Greeks all the way to our time. We have taught stand-alone individuals, stand-alone processors.

The third theme is that — because of the fact that a head must be of some use for specific tasks, especially when educated — everybody has to be educated to be an expert. The emphasis is on the expertise. Whether it is "well made" or "well filled," it has to be "well." It has to be some form of perfection. So expertise is an issue of knowledge, and access and processing of knowledge, which is very much put in question today by our new technologies.

Let's go a little bit further on the first theme, that of the influence of media on educational practices. It is clear that the invention of the alphabet by the Greeks created the schoolhouse. Not only that, it also created the segmentation of the use of time by students in the schoolhouse and even the manner of segmentation. You would first learn vowels, and then consonants, and then you would learn things like history and geography, and so on. From the very start, this was a structuring of the educational and pedagogical environment by a medium. We find also that before the appearance of printing, universities had already been created. Universities allowed a concentration of books and a concentration of talents that created a very specific kind of centralization of information processing. This is part of the condition of the media-related pedagogy.

This fundamental pedagogical cluster: the stand alone-pupil, the broadcast model of teaching, the concentration of expertise, the storage in libraries of information — in fact, the total environment of teaching and thinking about teaching — remain prevalent and unquestioned until the appearance of TV. Suddenly TV arrives and introduces a major conflict — pedagogically speaking, a mental dissonance because TV does two things which seem to do some harm to books.

First, television puts the processing of the images and imagination outside the head on a screen, so it's not happening inside the head anymore as it would if you were reading. It's happening in front of you. That's a major difference. And second, television also recollectivizes, somehow, information processing. Instead of being a personally controlled one where you control language, you control the writing of thinking, you control the content of thinking — all that stuff which is your private property as a reader suddenly becomes a public domain on TV. That public domain challenges tremendously the private domain and, in fact, leaves very little room to criticize the public domain.

Computers, in turn, are kinds of "electronic books." They bring back the power to the individual and the power of individual control over the screen.

— Derrick de Kerckhove

Hence the big issue: Do you really think when you watch TV? Well you don't really have to, so why should you when you are tired? So there is a whole question of the challenges of the practice of education by the television environment, which led to many experimental forms of education in the 1960s and 70s (e.g. Summerville, S.E.E.D., Montessori, student-centered teaching, méthode Freynet, etc.). Television was a very big pedagogical issue because it had become a form of collective education all at once, and it still is in many ways, but we haven't recognized its values that way.

Computers, in turn, are kinds of "electronic books." They bring back the power to the individual and the power of individual control over the screen. It's important to know that when you negotiate information with what happens on the screen you become responsible for it. You share the responsibility of the processing of the information. It's still processed outside the head, but there is a constant exchange between what's happening inside the head and what's happening outside on the computer screen — hence the recovery of individual and autonomous control of information processing via the screen. It's an important step, but a very short step in the history of intelligence.

Why? Because the next step is now and you are in it. It's the step of Internet where you negotiate meaning with the screen — yes — but through the screen with any number of people. That's a fantastic change of the processing: the change of our intellectual faculties and their distribution in terms of person versus collective, person versus connective. We're into probably as big, if not bigger, a revolution of mind today as was experienced by the Renaissance. Let us hope it is not followed by 200 years of bloodshed as it was in the Renaissance when religious leaders on all sides appropriated the contents of the Scriptures and made them support their personal brands of religion.

The present shift of the broadcast to the network model is what happens in an intelligent processing environment when instead of a single source blasting its content at a large number of people (which is the mass culture, which television reinforced), there is a network communication environment where people, by interconnecting, not only have a feedback and feedforward capability being able to dialogue with each other and answer back to the source and become themselves sources; but also can allow themselves to be the complements of other sources. And hence an endless reconfiguration of just-in-time collaboration. An extraordinarily different model of the economy, an extraordinarily different model of everything — of social behaviour, and probably very soon of politics too, certainly of pedagogy.

The McLuhan Program created the World Series, which was a very naive and tentative beginning of a network educational environment. Our first live multipoint network was with Holland. Instead of having point-to-point video conferencing, we had four universities connected in real time across the Atlantic, with people bringing their information on what they were working on to all the other points at once. I find that an interesting extension of the broadcast model, because it is still the source sending information to the other three and then eventually a return, because in video-conferencing you can have a return. It was modest way of going from the broadcast model to the network model.

> The real network model is one in which instead of using just video-conferencing, you use the Internet as well. You put in a Website all the information as it comes in the course, queries and answers, … a whole series of possibilities.

The real network model is one in which instead of using just video-conferencing, you use the Internet as well. You put in a Website all the information as it comes in the course, queries and answers, … a whole series of possibilities. You have access to a personal database for the class, and for the network, communication among several universities. It's great! It really works. But it's still modest because I think that the view of the student in such circumstances remains the stand alone, the individual who networks to increase access to information and perhaps to start and initiate collaboration. The students are not themselves perceived as networks.

Individualism is something we all suffer from to a great degree. Not that it's a bad thing, but an overly individualistic society that considers the individual in separation of that person's context is very much a text-based society. All text-based societies look at text and think they can do without the context. Individuals, in fact, have a huge context. In the 1960s, we rediscovered the context of the family, the context of the social environment, the context of the school. It's not that we ignore the context, but we still think about people as stand-alone processors. We don't yet think of them as interconnected, as they are, for example, in a family environment.

Intelligence in an individual person is grounded in language, clearly, but also in a physiological system that requires a collaboration of great numbers of neurons in synaptic connections. The synaptic connections make each neuron capable of something like ten to twenty thousand connections. Not all these connections are used at the same time, and not all the neurons are used at the same time; but for every thought, every gesture, every move, there are a number of them used and in different configurations.

In other words, the very model of networking is in the structure of the brain. So the fundamental model is there. And each one of these neurons can be used for plenty of things other than for that particular function at that time. Each one of these synapses can reconnect with other synaptic connections in different configurations at any time for different purposes. This is all contained into a single person. This is what we are educating. This is a form of personal intelligence, personal learning, that we are familiar with and we tend to think that it's all there is to work on.

What I see in the environment created by the Internet, and more and more software within that model, is that there is a possibility of connecting individuals not only for exchange of information or for depositing information, but connecting them for work either in real time or delayed time, connecting them in very interesting configurations. For example, Idea Futures is a Website where you can post an idea or hypothesis you have and give it a dollar value. The dollars are digital and drawn from an account which is given a fresh supply of 50 e-dollars every week (as in a Monopoly game). You can also invest your e-money in other people's ideas that you select from an index on the site. You can later check your part of the site to see how much value other people have added to your idea. People can also leave suggestions to refine your idea. Ideas and suggestions are crosslisted to other ideas and these suggestions together make a cluster around specific themes that you can explore.

This is a form of connected intelligence in real time that increases the value and the definition of an idea. We can always arrange our thoughts into interconnected clusters in our own mind. You always have an idea-futures device in your head, evaluating your thinking more as it becomes more and more relevant to the context that you are studying. But that is something you can do with the Net only when other people are involved.

You will see more and more software on the Internet that will assist human communication. But the real news is that you don't need technology to assist human mindware. It's already there but largely untapped. We have failed to see the connection of connected intelligence for all the centuries of stand-alone individualism that we have had. Connected intelligence can be perceived on-line, and that's where the model came from. You can use the Net now to see how it works. Teachers and scholars need critical tools and an observation point from where they can find out what are the forms of intelligence that are now unfolding on the Net that one can measure.

> But the real news is that you don't need technology to assist human mindware. It's already there but largely untapped. We have failed to see the connection for all the centuries of stand-alone individualism that we have had.

I can see connected intelligence happening among my students. As I started working on the grammar of connected intelligence on the Net, I suddenly realized, "I can't believe it!" We've been living for several millennia with that phenomenon happening all around us without recognizing it for what is, a perfectly normal group behavior. An educator for 30 years, I had not recognized how much of this connected intelligence is already there and how much of a grammar there already is that nobody has studied. Among my students, of course, I had never used it. Now I am beginning to invent or discover new methods that bring students to work together in structured ways on specific, preferably real life projects. So this is why it's exciting to understand that there are ways by which you can connect your own students among themselves that makes huge pedagogical sense.

Forget man-machine interaction; that's not interesting. It's person-to-person interaction via machine that is interesting. I think it's important to remember, too, that you will always need bodies out there to do the real thing. No machine can do what people do simply by being together. The essential value of the offline in education is that you have people. Why is it that people are so important in the context? If you are dealing with a problem and you are only calling upon experts, you are going to stay so close to the problem and so close to the context that you all have the same text. You will all come up with the same, and usually predictable response. What happens when people physically get together is that they develop energy, a form of energy that cannot be found on-line. You'll find a different kind of energy on-line, but the bodies of people generate energy, intellectual, connected cognitive energy that you cannot find with pure on-line communications.

The presence of ignorance, of not-knowledge, is just as important as the presence of knowledge, and you can't find that on-line. You can't find ignorance on-line. You can find idiots on line, — plenty of them, — but you can't find ignorance. It's not the same thing. To really know what the problem is you need people who don't know. You need non-experts. You need to blend the non-experts and experts.

The shape of ignorance is almost as precise as that of knowledge, but it's less visible. I remember one example in one of the workshops we did in Melbourne. An aboriginal person came up to me and said, "I don't know what I'm doing here, I don't know anything." I didn't know what to answer; I was just beginning in this thing, and I said, "Well, we think you're great. You are a real asset to this group just by being with us. I don't think you should leave." And I persuaded him to stay. He said a lot of very interesting things. He had this aboriginal sensibility and he certainly saw things differently than we did. At one time he said, "When I leave Melbourne, I leave the 20th century behind," and we suddenly all saw 50,000 years of survival in the most rigorous conditions and our technological developments and all our work at it as a tiny, tiny dot in that 50,000 years. This was this man's ignorance. The shape of his ignorance was absolutely loaded with expertise. He gave us something entirely different as a perspective and a point of view on the reality we were working on. Our job was to find ways of dealing with virtual reality to save some of the land invaded by tourists. It was a job given by the government to find out how you can manage traffic of tourists so as not to hurt the environment. We learned a lot about the environment from 50,000 years of dealing with it. That was fantastic. One of my conclusions would be that blending experts and non-experts in any one of your workshops is a very important and valuable exercise.

> To really know what the problem is you need people who don't know. You need non-experts. You need to blend the non-experts and experts.

We have to understand that when we are looking at the user technology and how it transformed the sensibility of the people and the educational patterns, we have to recognize that the technology itself does not replace the people in that context, even in the context of pedagogical work. What we educate is people, not experts. In a society where the stand alone is now suddenly challenged by the collaboration of network communication and network intelligence, what you need is the complexity of the person as well as the refinement of the expertise. At the University of Toronto right now there seem to be many decisions that more and more of whatever's left of the investment is going to go into more and more hard science, more and more specialization, and more and more expertise. I think that certainly in the school environment, and I would say also in the university, the non-expertise has to be an inspiration to teach people and not just experts.

It will be much more important to have an intelligent ignorance in the immediate future than to have a narrow expertise. It will be much more important to be flexible, especially if one considers that the future of jobs is not that great either. Pre-defined jobs for which an expertise is necessary are going to be fewer and fewer. It will be just-in-time communities of people who are working together. If you teach your students to network in their classrooms, not only on-line, you are teaching them the future. You will be prefiguring the job environment that they will probably be living in.

The last thing I might say is a sort of purely technical issue, but whereas I have no problem networking the intelligence of my students in workshops in Melbourne or in Cologne or in France, I found it extremely difficult to do it in Toronto. I am a professor here and I should be able to do that with my own students, but I can't. Why? Because of the fact that the structuring of the time and space use of the University make it impossible to have a continuous workshop environment unless you take it in the weekend. Your students and the curricula are based in the traditional assembly line kind of thing, segmented periods of content per session. And then you may have a seminar of an hour or two to pick up on what was said in the lecture. But that's not a very good model.

What we need to do, especially when we are using connected instruments, is to actually have longer segments of time to work with our students and be able to make that connected intelligence work in a concentrated way. Otherwise it's very diluted. In a standard classroom the best you can get is a one on one. Very often in university, students don't know one another's name at the end of the year. I don't think you can generate much intelligence, much energy, and much power, and much self-learning power if you don't take advantage of the incredible multiplication of mind by mind that comes from networked intelligence.

Technology in the Common Curriculum

A Conversation with Judy Coghill and Ron Wideman

This conversation with Judy Coghill, of the Curriculum, Teaching and Learning Branch, Ministry of Education and Training, and *Orbit* Guest Editor Ron Wideman took place in October 1996. Judy has worked on Ontario's Common Curriculum since 1994 in her capacity as Education Officer. Ron coordinated the development of *The Common Curriculum, Grades 1 to 9* for the Ministry of Education and Training.

Ron The *Common Curriculum* was written as curriculum for the information age. Let's begin by talking about some of the implications of the information age for curriculum and learning.

Judy The shift from an information-poor to an information-rich society has several significant implications. First, the classroom no longer is the primary source of knowledge, if it ever was.

Second, teachers need to recognize their changing role, from source of knowledge to a facilitator or a guide. Teachers can no longer control what kids know, what students are exposed to whether through the Internet or through MuchMusic or through a whole range of other sources that they have the ability to connect with outside of the classroom. The teacher really becomes a co-learner.

And third, I think one of the most significant changes in actual classroom learning is the focus on higher order thinking skills. These need to be at the centre of all learning because we have to help students manage their own learning and understand how they learn.

A fourth implication is that there will be more choices for students in how they will go about their learning. We know that some students are severely restricted if they rely on pen and paper. The research on multiple intelligences and learning styles over the last decade or so has indicated to us that we must offer student learnings in a variety of media and at the same time offer them a variety of media in which to represent their learning.

Ron Technology is obviously a key element in this shift. Where do we find technology in the *Common Curriculum*?

Judy Technology is found in the *Common Curriculum* both as an object of study and as a vehicle for learning. As an object of study, it appears in the Math, Science, and Technology area — under broad-based technology in what might be called "design, build and test" outcomes. It is also found as an object of study in the Language program area under "viewing and representing." As a vehicle for learning, technology is part of a program called "Functioning in the Age of Information" in Personal and Social Studies.

However, I would argue that technology permeates the *Common Curriculum* in the learning outcomes expected for Grades 1 to 9. In the new curriculum being developed for kindergarten, there will be associated expectations in relation to the end-of-Grade 3 outcomes. And of course the third essential learning outcome in the *Common Curriculum* is specifically technology-related.

Classroom teachers need to be familiar with a wide range of technologies and comfortable using the computer for a wide range of uses — e-mail, the Internet, CD-Rom's and a range of softwares.

— Judy Coghill

Ron My son Ben just finished a project on spiders — he's in Grade 4 — and he did it all on the wordprocessor. He inputted the information, edited it, laid it out, and printed it off. Another kid had taken his video camera to the pet store and talked the pet store owner into getting the tarantula out of its cage and letting him videotape it. The creativity involved in both projects was remarkable. Is there any indication that it's time to rethink what the basics are?

Judy When we were developing the curriculum requirements for writing this past summer, there was considerable discussion about whether we need to require that students are able to print first and then cursive write, and then at some point later in their school careers be taught how to keyboard. Perhaps we should offer students the choice and allow them to keyboard first? This would certainly help the kids who have difficulty with motor coordination at an early age, or some of the gifted students who are identified as learning disabled, because they think faster than they can write.

Ron Some of our research at TVO identified multiple technologies as a much more effective way of dealing with multiple intelligences and different learning styles. This is very important because although there were lots of jobs available in the past for those who didn't do well in school, our economy is changing and those jobs are disappearing. I think the new technologies give us a remarkable opportunity to serve students of many different kinds of skill. Are you optimistic about this potential?

Judy Ron, I think you're also suggesting that in the old paradigm the technical areas were seen as the less academic ones, but now that distinction is being blurred. The academic and the technology areas are becoming one, really, and this will require a major adjustment. And yet, despite what the research tells us about the ideal potential of multiple technologies and curriculum and learning, we know that equal access is a real issue. Kids who have been around computers since before they were one year old have an advantage.

Ron Yet 100 years ago there were children who had a much greater access to books and the tradition of writing and reading and other skills. So I'm not sure that equity is a new issue. Still we've got to find a way of levelling the playing field and ensuring that the new technologies are used effectively in the classroom. What are some key strategies here?

Judy One key is teacher training. Classroom teachers need to be familiar with a wide range of technologies and comfortable using the computer for a wide range of uses — e-mail, the Internet, CD-Rom's and a range of softwares. There also seems to be a need for development of more effective means of assessing student use of technology in the classroom. Technology needs to be an integral component of curriculum to provide a stimulus for problem solving or to provide a wide and rich range of methods for problem solving and investigation, whether it's through telecommunications or computer simulations.

Ron One of the things that is developing is an amalgamation of various technologies — video, computer, and electronic networks, along with print and other technologies — for teaching and learning. But we don't have many models or illustrations for teachers for what the use of these technologies should look like in the classroom curriculum. Isn't there a tendency to treat the new technology like the older technology?

Judy Yes, I remember being taken as a kid into the gymnasium to watch television on one monitor. We would all sit on the floor in front of the television set — it was a TVO presentation, I remember — and then we'd all go back to our classroom and do what we had done all the other days. This analogy seems to work, unfortunately, with computers as well. We started by moving them into a special room — the computer lab — and lining them all up. Then we brought the kids in to do something and then we took them back to the classroom where they would continue to work with pen and paper the way they would have normally. The movement of the computers out of the labs and into the classrooms, into the networking of the classrooms, the schools, and school systems is the beginning of a new model.

I think the new technologies give us a remarkable opportunity to serve students of many different kinds of skill.

— Ron Wideman

Ron Are there are other concerns that you have about the introduction of technology into the school curriculum?

Judy We need to be careful that we don't lose sight of the need for balance when we set out our expectations for schools. There is a concern that we may immerse children at too young an age in a totally technological environment and lose the emphasis on interpersonal development.

There's also a real fear among teachers of being supplanted by machines. And similarly, there are parents who may not be conversant with the new technologies and who will feel further displaced from their children's learning and perhaps from education entirely. There's a tendency to be seduced by the technology but the technology in itself is not the curriculum. There still is the need for teachers to plan and to structure the learning. So there are very clearly access issues connected with technology and we have to think these through as we introduce technology increasingly into our classrooms.

Ron *The Common Curriculum* doesn't have just technology outcomes. It has many kinds of outcomes, including those that have to do with values, interpersonal development, and co-operative skills. You simply can't implement technology in a manner that stands in the way of achievement of other important outcomes. It's got to be helpful for those purposes. If it's not helpful, you shouldn't be using it. One technology won't do it all, but if we've got 21st century technology, let's make sure we use it right, rather than treat it as a virtue to not use it.

Judy I support that as well, Ron, but I go back to this seduction by technology. It is isn't just introducing technology into the classroom, it's understanding how to use it. It's increasing the repertoire that's available both for the teacher and for the student.

Ron Look at the movement back in the early seventies and late sixties to equip every classroom with a television set. Television never really reached its potential because it simply was put in classrooms rather than being made an integral part of the curriculum.

Judy A colleague in New Zealand, Ron Martin, has done a lot of thinking around this. He talks about the virtual bank and how you can get access to dollars from almost any place you want to, other than the institution we've commonly seen as the solid building at the corner called the bank. It seems to me if the Interact is the key to the virtual bank then what's the key to the virtual classroom or school? What would that look like?

Ron This is the daydream for me and maybe it's the nightmare too — the technologies are really going to, and have already started to, have a major impact on the viability of schools as they currently exist. The sage on the stage teacher has been having more and more trouble since the advent of television. There are now much more compelling and entertaining ways to present and use the information via computers. The traditional school just can't compete with that.

Judy At the same time, distance learning is becoming a reality for more and more students at whatever age in the province. We may soon see the day when the traditional classroom is supplanted by a new kind of classroom we can only begin to imagine at this point.

Information Technology

Parents, Schools, and Corporate Partners

By CHRIS BRIDGE

Superintendent, Program Services
Peel Board of Education

It seems impossible to read a journal article or an editorial page without finding a reference or two to computer technology and its impact on our lives both individually and collectively as a society. There is a mystique surrounding the technology. Even those who neither own a computer nor have any computer skills themselves see the introduction of this technology into schools as a basic requirement for a good education. The technology appears to have the properties of a cure-all that will instantly resolve the problems surrounding the acquisition of such basic skills as reading and writing.

Pressure from Parents

Parents believe that schools must provide a grounding in computer skills if their children are to be able to obtain employment and function effectively in society on graduation. Increasingly all jobs require some level of computer literacy. Parents have been asking school principals and teachers to accelerate the offering of programs that develop skills with the technology. Many teachers have embraced this challenge but others have been reluctant to adopt the new technology for a variety of reasons.

Change is always difficult, and computers have an aura of complexity that causes many to shy away from their use. Parents have had significant influence in changing teacher behaviour as they have actively engaged in fund-raising activities to provide computers for schools. In some instances, parents who have computer skills have volunteered in the schools to assist teachers.

Fullan, in *Successful School Improvement*, refers to studies by Carmichael indicating that parental involvement in the school changes teachers' and principals' attitudes towards the technology and effectively spurs the implementation process. As a by-product, parents become more involved in their child's education, an activity which many researchers have found to have a positive effect on student learning.

Ironically, using a computer demands high levels of performance in the traditional literacy skills of reading, writing, and mathematical computation. At the same time, the computer offers opportunities to assist students to gain proficiency in these skills. In Ontario, the Education Quality and Accountability Office is beginning provincial testing in basic skills, the results of which will be made public. As well, all Ontario schools initiated parent advisory councils in September 1996. Principals will soon be in a position of reporting on scores in their school and relating that to an action plan to address real or perceived deficiencies. This increased local accountability will serve to heighten the demand for action and for the acceleration of the use of the computer as a solution. In teaching reading, teachers know that no one method will work with all of the children and that it is unrealistic to expect that the computer would solve the problems uncovered through provincial testing.

> A rich computer environment in the home gives advantages to some students. The public school, in spite of budget restraints and reductions, must strive to level the playing field.

To compound the issue for the principal, not all communities are created equal. Sales data regarding home computers indicate that the majority of purchases to date have been made by families with above-average income. This raises a fundamental concern about equity of access. Public education is the foundation of a democratic society. The ability to acquire, interpret, and assess information is critical to effective citizenship. As much of this information is increasingly presented through computer-based telecommunications, the urgency for the school to address these critical skills in the curriculum becomes apparent. In Ontario, the *Common Curriculum* calls for equity of outcome and defines specific computer-related skills that all students must acquire. A rich computer environment in the home gives advantages to some students. The public school, in spite of budget restraints and reductions, must strive to level the playing field.

Corporate Involvement

In addressing the need to have computer hardware available for students, many schools have sought corporate as well as parental assistance. Corporate involvement has taken a number of forms: cash donations to schools, donations of used equipment, donations of staff time and expertise, and partnerships to develop and enhance new products to assist the learning process. These relationships have potentially both positive and negative consequences for schools.

In designing a technology plan for a school system, a number of criteria must be addressed. The following list, extracted from a more extensive one developed by Jones et al. (1994), is helpful when considering parental or corporate contributions of technology:

- connectivity: the ability of the technology to connect with the rich resources both within and beyond the school
- interactivity: promoting the interaction that occurs when teachers and students communicate in a variety of formats
- equity of use: the provision of rich and challenging learning opportunities to all students
- interoperability: the capacity of the technology to connect with other hardware and software to provide greatest access for all students
- open architecture: providing access to third-party hardware and software
- transparency: ensuring ease of use for the user who is unaware of the procedures used by the hardware and software to facilitate their work
- provide challenging tasks, opportunities, and experiences: presenting complex problems and cases, linking to external resources such as museum collections, access to peers and experts in diverse fields, access to multimedia resources, and providing tools for investigation and research such as browsing and searching strategies

When a corporation participates with a school though donation of cash or technical expertise, the school staff has the opportunity to use those additional resources to purchase hardware and software that meet student learning needs, are compatible with existing school and system hardware and software, and ensure that technical and instructional support is available to teachers from board resources. Hardware and software resources can be purchased which provide that challenging and stimulating learning environment.

When used or refurbished equipment is provided, it may not meet the school's requirements. Challenging learning environments require complex programs which in turn require complex, efficient operating systems and large memory capabilities. Increasingly, good educational software requires high-level computer technology. Job settings require students to apply skills acquired on recent technology. Often the refurbished equipment cannot be integrated into network systems in schools and boards, thus reducing access to resources such as the Internet. In some cases, used equipment saddles the school and board technical staff with repair costs and lost time from productive learning activity. The staff of the school are placed in a difficult situation when presented with used equipment as they often lack the technical knowledge to assess the capabilities of the gift. Certainly, simple computer systems continue to have a role in a school setting such as teaching basic keyboarding skills. However, if the playing field is to be levelled and students prepared for a new reality in the workplace, then it is incumbent on the school to ensure the best learning environment. Consider this point of view:

Stage 1. New technologies are used with the content of an older medium.

Stage 2. New technologies are used to do old things more effectively and efficiently.

Stage 3. New technologies are used to do new things.

Surely schools must reach the third stage if students are to acquire relevant skills. Having students write with pencil and paper and then transcribe their work through a keyboard into a computer is a first level application. Accessing information electronically improves efficiency through the use of bulletin board technology but without the capability to download, analyse, and manipulate that information, the learning process is less effective.

Effective Partnerships

Partnerships between schools and corporations focussed on the improvement or creation of new learning tools have significant benefit for student learning. In a recent partnership with TVOntario, staff in two schools within the Peel Board had the opportunity to pilot a multimedia kit. The teachers benefited from the outside expertise and honed their skills in the use of information technologies. TVOntario and the future purchasers of the resource will benefit from the teacher manual developed by practicing teachers.

However, the students were significant beneficiaries. The resource provided a rich learning environment that allowed students to pose critical and relevant questions for investigation as well as the opportunity to carry out a significant array of investigations and to present their results in a multimedia presentation as a part of the demonstration of their learning. Students acquired critical skills not only in the new technology but also in more traditional basics such as writing, reading, and library research. More critical is the fact that students were able to apply their learning to local issues and to propose practical approaches to the solution of those issues. This partnership provided real and relevant education for students, a response to the pleas of students recorded in Ontario's recent Royal Commission on Learning. The application, however, required multimedia capability not found in many older computers.

In light of the interest expressed by parents and corporations for involvement in the learning process, the Peel Board recently adopted a policy on partnerships and fundraising. The policy defines a partnership as the collaborative effort of schools, community, and business to prepare students to function productively in society as worker, consumer, citizen, and lifelong learner through the exchange of human, intellectual, and/or material resources to the mutual benefit of all involved. In the policy, the Board subscribes to these ethical guidelines developed by the Conference Board of Canada for Business-Education partnerships (Bloom, 1994).

Partnerships are supported which:

- enhance the quality and relevance of education for learners
- mutually benefit all partners
- treat fairly and equitably all those served by the partnership
- provide opportunities for all partners to meet their shared social responsibilities toward education
- acknowledge and celebrate each partner's contributions through appropriate forms of recognition
- are consistent with the ethics and core values of all partners
- are based on clearly defined expectations of all partners
- are based on shared or aligned objectives that support the goals of the partner organizations
- allocate resources to complement and not replace public funding for education
- measure and evaluate partnership performance to make informed decisions to ensure continuous improvement
- are developed and structured in consultation with all partners
- recognize and respect each partner's expertise
- identify clearly defined roles and responsibilities for all partners
- involve individual participants on a voluntary basis

The adoption of this policy will allow schools to welcome partnering associations backed by a set of principles that foster student learning.

In the end, the effectiveness of the new information technologies in the schools will be measured by their impact on demonstrated student learning not by the ratio of hardware pieces to students. The acquisition of hardware without improved student performance negates the great potential of the computer to enhance opportunities for students. It is essential that teacher training focus on how the computer can be used effectively as a tool for learning. Parents, teachers, and corporations working together can enhance these opportunities.

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Section 2

EMERGING CLASSROOM AND SCHOOL PROGRAMS

What are some of the new technology-based classroom practices?

✿

How are they working so far?

✿

What impact is the new technology having on teaching and learning?

✿

What has been learned about the need for teacher education and user support?

✿

CLASSROOM PROGRAMS

Knowledge-Building Environments

Creating An Alternative Classroom Culture

By JIM WEBB

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Over the past decade, I have been privileged to be a participant in an exciting research and development project that has grown from two classrooms and a small group of researchers into a widely recognized knowledge-building environment currently used in schools all over North America. Computer Supported Intentional Learning Environments (CSILE) continues to grow and improve because it carries in its approach the impetus for its own evolution.

CSILE was originated by Professors Marlene Scardamalia and Carl Bereiter, cognitive scientists at the Centre for Applied Cognitive Science at OISE/UT. CSILE was in part based on their earlier research into children's writing and thinking. Some of that research was conducted at Huron Street Public School in Toronto. The initial two classrooms of the CSILE project were also at Huron.

Since the beginning, the CSILE development team has comprised students (both elementary and graduate level), cognitive scientists, programmers, researchers, and classroom teachers. The success which the project has enjoyed can be attributed, in large part, to the collaborative efforts of all those involved, particularly the elementary students. The Grade 5 and 6 pupils have never been viewed as mere users of the system or research subjects. They are consulted regularly for their critical appraisal of the system. They know what works well and what needs to be changed, both at the technical and cognitive levels.

How CSILE Works

CSILE is both a software package and an educational philosophy. Students use the software to produce notes which are sent across a network and stored in a central database. All notes stored in the database can be retrieved and examined by everyone in the class. As its name implies, the program was designed to encourage intentional learning. All of the original features of CSILE and many refinements and extensions are now included in the current version.

Students are encouraged to define the type of learning which they wish to engage in before they make an entry on CSILE. These entries can include a problem statement, a theory about a problem, something a student needs to understand to progress towards the solution of a problem, a comment to another student, or some new learning related to a problem. Each student is able to read every other student's notes and to comment on them if desired. Comments are electronically linked to their target notes and those links can be followed in either direction.

In addition to writing text notes, it is possible to create graphics notes which can be labelled and which can also contain some text. Graphics may be linked to text notes and additional graphics can be linked through labels, allowing students to build a "zoom-in" view, which can be particularly useful when a change of scale is needed to illustrate some aspect of the problem being studied.

Students add keywords to their notes, allowing and encouraging an awareness of cognitive links between diverse areas of study. The assignment of keywords also requires students to define the central concepts in their notes.

CSILE also contains a "User Dictionary" for each student. This is actually a modified spelling checker which each student builds during the revision and editing stages of his or her work. The "Dictionary Builder" highlights each word which appears in the student's text but is not yet in that student's User Dictionary. It is the student's responsibility to determine if the word is incorrectly spelled and should be corrected or if it is correct and should be added to the User Dictionary. Words which have been added to the User Dictionary will not be highlighted if they are encountered in subsequent text entries.

This is the basic outline of the features of CSILE. However, its use in the classroom can be quite variable depending on the learning culture which is being fostered.

From Topics to Problems and Problem Spaces

My students and I have been working closely with Jim Hewitt, a member of the CSILE development team. We have been experimenting with system designs intended to change the focus of students' attention from topics to problems, particularly problems centred on processes, and to increase students' awareness of the thinking and learning of their peers. We have also tried to make the structure of the database more visible so students would be encouraged to explore more often.

One of the features which we have used with some success is the "discussion note." This is a special note used for text entries. Any number of students may work in the same discussion note (or "problem space" as I prefer to call it, for reasons I will explain later) at the same time. Each time the note is retrieved it is updated, or it can be updated while it is open by clicking on a refresher button. Students join a problem space because they are required to or, preferably, because they are interested in the problem being examined.

Students usually begin by entering their theories and thoughts about a problem. Subsequently they enter what they need to understand in order to build their knowledge about the problem and move closer to its solution. Each entry is automatically numbered and prefaced by the "thinking type": "My Theory," "I Need To Understand," "Comment," "New Information," "What We Have Learned," and so on. The initials of the student writing the entry automatically appear at the end of the entry. Sometimes an I Need To Understand (INTU) entry is sufficiently broad in scope that it becomes a "subdiscussion" which is a separate, but linked, discussion note. For example, in the problem space, "How does the heart work?" a student entered an INTU, "What are the different blood cells and how do they work?" This INTU became a subdiscussion which was an important contribution in its own right.

Using discussion notes reduces the total number of notes in the database and presents the students with an easily viewed history of current knowledge-building activity on a particular problem. It is also possible to build hypermedia links from words in entries to related graphics.

We have also experimented with a graphical representation of the database called a "Knowledge Map." This single screen shows every note in a particular section of the database; for example, notes related to the problem, "How Heat Affects Matter." Over a number of days, clusters of related discussion notes appear on the Knowledge Map. These can be created by students or by the teacher and might include problem spaces — such as "How does heat affect solids?" — and related problem spaces — such as "Why do some solids melt while other solids burn?" and "What happens inside a metal rod when it expands?"

If a note is a subdiscussion or a linked graphic, link lines automatically appear, and the user who creates the note places it in an appropriate location on the Knowledge Map, usually close to the notes to which it is linked. Different types of notes are represented by unique geometric symbols. Any note can be retrieved by double-clicking on its symbol, so textbased, pulldown windows are not necessary. User supports include the ability to highlight notes which any user has created, worked on, or read. Text can also be added to the Knowledge Map screen by the teacher, making it possible to label different areas for easy reference. It has been interesting to watch the development of the database through the Knowledge Map, particularly the links that appear within and between areas. Zones of frequent cognitive activity are readily apparent.

Changing the Classroom Culture

CSILE is a potentially rich and powerful medium for students of all ages. It has been used successfully by students from Grade 1 to graduate school and by practising teachers. Even now teachers at various CSILE sites are linked through the Progressive Curriculum Network (PCN); a CSILEbased, electronic environment where teachers can join discussion notes which examine issues which have arisen in their classrooms.

However, I believe that the real potential of CSILE lies in the role it can play in the development of an alternative learning environment. For teachers who are interested in changing the culture of their classrooms from a "transmission model" or an "activity approach" into one which stresses knowledge building, CSILE can provide the support and focus to facilitate the transition.

Many classrooms today are based on the so-called transmission model. A knowledgeable teacher presents a core of information and/or skills which students are expected to learn and practise. Direct teaching is the predominant instructional mode. It continues to be a valuable approach which is used to varying degrees in most classrooms. The frequency of use of the transmission model often increases with the age of the students.

The activity approach also has many adherents. If students are actually engaged in the manipulation of materials, whether in science, math, or language, it is felt that their learning will be more complete and at a deeper level than it would be if they were only told about it or read about it. Undoubtedly, this is true. Teachers also have their students complete follow-up activities which require the students to use and extend skills and knowledge from the primary area of study and from related areas, most commonly language.

I am not suggesting that the transmission model or the activity model are undesirable and should not be used. They are components of most classroom environments and have an important role to play. I suggest, though, that these models make it more difficult for students to develop the skills and attitudes which constructivists consider to be important, both for the individual and for the knowledgebased society which is rapidly developing.

Generally, students approach their everyday school experiences as a series of tasks organized under various topics. When asked what they have learned, they often respond by listing a series of subjects or topics. For example, students often begin math assignments with little attention to the accompanying instructions or explanations. The predominant approach involves the manipulation of the numbers to arrive at the correct solution. The algorithm becomes all important. The purpose of the activity or its relation to previous learning is lost in the devotion to the task. Research progresses by using the copy-paste technique to transfer information from books or other media to the student's "own" format, the form of which may assume paramount importance, at least to the student. Even computer-assisted reports may rely heavily on multimedia cut-and-paste techniques.

One of the main reasons that I prefer to use the terms "problems" rather than "topics," and "problem spaces" rather than "notes" is that it helps to focus students on learning goals and the solution of process problems rather than the accumulation of information and the mastery of algorithms. It is important to remind students constantly that they should be defining learning goals and knowledge gaps before they begin any work — math, research, or writing. All activity, in CSILE or not, should be undertaken to build knowledge about a problem, and that problem should be foremost in the student's mind. It is vital for students to concentrate less on "what" is happening and more on "how" and "why" it is happening.

In my own attempts to change the classroom culture, I have found it necessary to devote considerable time and effort to helping students to develop collaboration skills, both on and off CSILE. Another challenge has been to help students overcome their task-centred approach, focus on finding the gaps in their own understanding, and then follow through in filling those gaps.

The CSILE system would be useful even if it were used on an irregular basis. Making it the focus of the classroom environment can provide significantly greater benefits and can assist in the transformation of the classroom culture. The CSILE approach is an attempt to create a classroom culture which moves away from one which emphasizes an individual and/or cooperative topic/task approach to one that emphasizes a problembased, collaborative, intentional, knowledge-building approach.

CSILE classroom environments attempt to move beyond proficiency to understanding. There can be important learning which results from doing activities, but using the new knowledge, especially when it extends into areas not accessible firsthand, can be even more valuable. Initial problems for knowledge building may be defined by the teacher, but thereafter the students' recognition of their own knowledge gaps will dictate the course of inquiry. In this way, learning which may have been an almost incidental result of classroom activities becomes an intentional result based on students' cognitive needs.

> When students are asked to work collaboratively, even as a whole class, to build their knowledge in problem spaces such as "What happens inside the wire of a bulb when it lights up?" or "How does a battery produce electricity?" …, and they are requested not to research the problem in their normal fashion, the results can be quite surprising.

Learning by doing can be extended considerably if students are expected to use their new findings to collaboratively build new knowledge in areas related to their initial experiences, whether hands-on or otherwise. CSILE classroom cultures encourage development which results in considerable depth of learning. For example, having completed a number of activities with electrical apparatus (making circuits, studying conductors, making electromagnets, among others), students might be asked to use CSILE to build and extend their knowledge during what can be called the "deepthinking stage" of the study of how electricity works.

When students are asked to work collaboratively, even as a whole class, to build their knowledge in problem spaces such as "What happens inside the wire of a bulb when it lights up?" or "How does a battery produce electricity?" or "Why does water and salt conduct a weak electric current, but plain water does not?" and they are requested not to research the problem in their normal fashion, the results can be quite surprising. Students join the problem spaces they are most interested in and where they feel most comfortable, at least in the beginning. They enter their theories and they define the areas where they feel that their knowledge is lacking. The theories are often quite surprising, both in the ingenuity reflected in them and in the misconceptions which may be represented. Never have I been more aware of the level of cognitive development of my students as I have been in using CSILE. Others join the problem space and offer their thoughts on earlier theories; sometimes they define completely new theories. Graphics may also be used to explain theories or to extend the detail of the text entry.

The restriction on research can be relaxed after a number of sessions, and students will begin to enter their findings into the problem spaces, resulting in new theories and new INTU's. The depth of the discussions continues to grow and subdiscussions appear. The learning never really ends, but it is usually terminated because it is time to move on to something else. Nevertheless, in my experience, units of study using CSILE span a greater time frame than those without CSILE.

In the end — or more accurately, in the beginning — students have participated in a very different learning experience. They have been allowed to think deeply, to express their ideas freely, and to work with others to build their understanding of difficult problems. They have come to see themselves as members of a knowledge-building community. They have begun to prepare themselves to participate more meaningfully in the society of the future.

For more information about CSILE, please contact Dr. Angela Hildyard, Associate Dean of Research and Field Services (416) 923-6641, ext. 2381 or e-mail Angela_Hildyard@tednet.oise.utoronto.ca

TVO Galaxy Classroom® Pilot Project

Successful evaluation of an Integrated Curriculum and PD program

By JANET STERN

Project Manager
Distance Learning Division, TVOntario

In September 1995, TVOntario celebrated its 25th anniversary, continuing in its role as a leader in education, integrating technology into classroom learning activities in order to achieve meaningful, measurable results. Through ongoing explorations to improve curriculum programming, the TVO network identified The Galaxy Classroom project as an exciting opportunity for Ontario.

The TVO Galaxy Classroom — first piloted in Ontario in October 1995 — has generated enthusiasm for learning and recognition from educators for its blend of integrated curriculum for the classroom and teacher professional development. Galaxy Classroom was initially developed through a strong private sector-public sector partnership in the United States. As part of TVOntario's 25th anniversary curriculum activities, TVO became Galaxy's Canadian partner to bring the curriculum/technology/professional development resource to Ontario.

Over the course of the 1995/96 pilot year, the Ontario experience of the TVO Galaxy Classroom was carefully monitored and measured by a research team led by Dr. Terrance Boak, Dean, Faculty of Education, Brock University:

> One of the most astonishing results was the overwhelming approval of the program. Almost every person interviewed, including teachers, principals, vice-principals, and students, expressed deep satisfaction with the learning opportunities associated with the Galaxy program. (Boak et al., 1996, p. 14)

This article describes the TVO Galaxy Classroom as a model of curriculum development, reports on the research process and findings of the Brock University research project, and gives a look toward the future.

What Is Galaxy?

Objectives

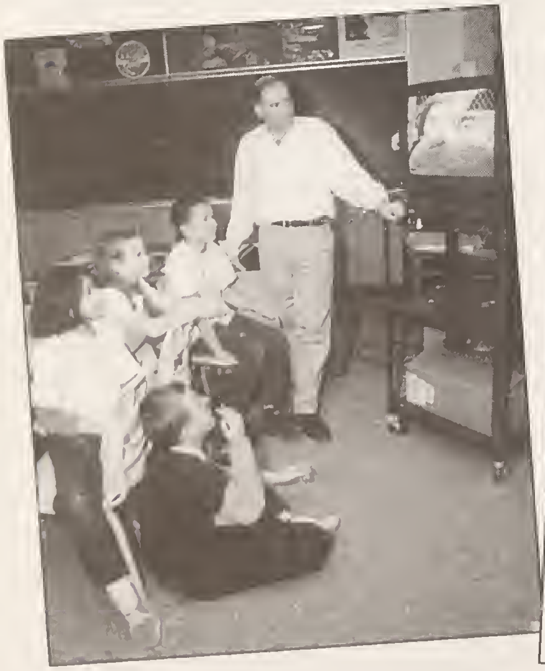
Galaxy is an elementary learning-resource network using interactive technology to meet student and teacher needs. All three Galaxy resource packages offer an innovative child-centred curriculum with clear links to the Ontario Common Curriculum. The main objectives are:

- to improve academic achievement among elementary school children who come from increasingly diverse ethnic, racial, social-economic, cultural, and linguistic backgrounds
- to promote educational excellence by incorporating instructionally sound subject matter content into programs developed for elementary school students
- to provide teacher professional development which promotes the sound use of educational television while helping teachers develop integrated approaches to the Ontario curriculum

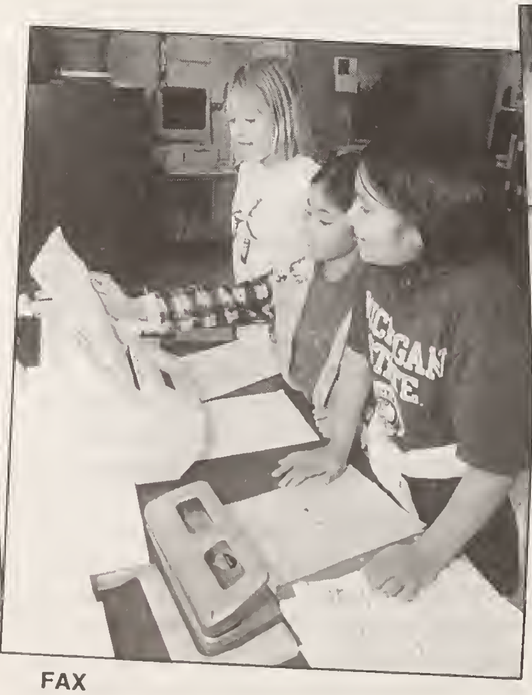
Technologies

The technologies used are high-tech/low tech including television programming — distributed by satellite, regular broadcast,

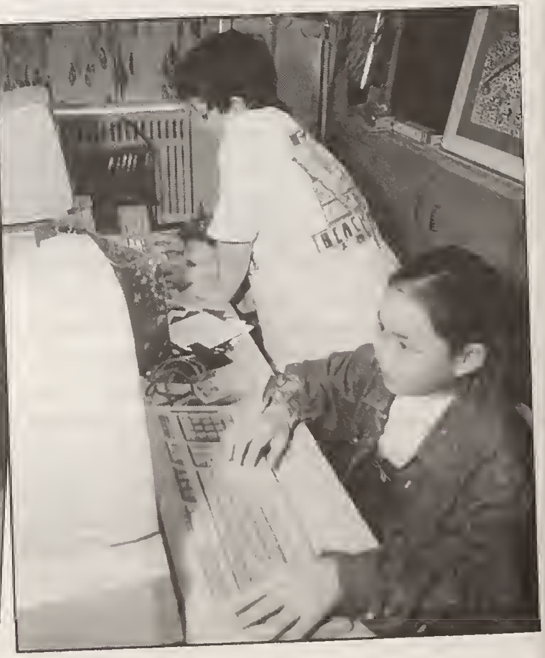
AN ELEMENTARY LEARNING RESOURCE NETWORK — HIGH-TECH/LOW-TECH



VIDEO



FAX



COMPUTER

or video — fax, phone, and e-mail. Televisions and VCR's as well as phones and fax machines are standard equipment in a majority of Ontario schools, so these form the basic technology framework. Schools with classroom access to computers and modems also incorporate e-mail exchanges with other schools. Participating schools receive faxes from the video characters. These time-sensitive messages launch new challenges, encourage student reaction, and acknowledge previous student participation. Students share ideas with those in other schools. They also get to see their work and ideas reflected in the special feeds which are part of every second video production, and this ignites an explosion of creativity and excitement on the part of teachers as well as students.

Professional Development

The teacher professional-development components continue throughout the school year and include an intensive three-day in-service program, support through a 1-800 phone number, exchanges between teachers and TVOntario's Distance Learning Division, and moderated contacts with Galaxy staff.

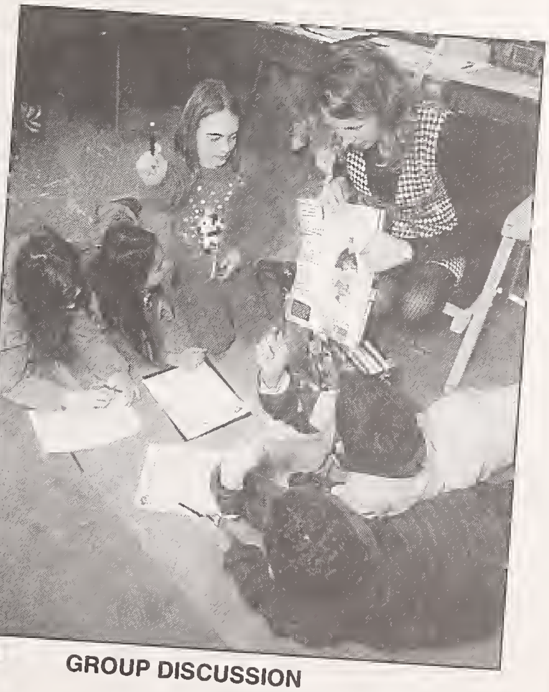
Curriculum

TVO Galaxy Classroom includes three curriculum packages. Fixer Uppers® (science for Grades 1 and 2), The House® (language arts, Grades 3 to 5), and S.N.O.O.P.S.® (science, Grades 4 to 6). The descriptions that follow are excerpted from TVO Galaxy Classroom literature, available on request from TVOntario.

Fixer Uppers is an interactive science curriculum supported by a 14-episode video series. The videos invite children to do real-life science experiments with Keisha, a Grade 2 student, and her father, Lee, an art education student as they work on "fixing up" their apartment. Many of the explorations and questions have open-ended outcomes, and the series provides learning opportunities that are underscored by drama, comedy, documentaries, and original animation. The goal is not to teach irrelevant facts but to enable a child to construct meaning by instilling a new way of observing and thinking about the world.

The House offers 15 reality-based video dramas dealing with issues close to the heart of kids. Some examples include privacy, space, attitude, justice, and getting along. The 15-minute videos broadcast every second week build on the strengths every child brings to the classroom and motivate kids through writing for real audiences (they fax or e-mail pals in other schools or the hosts of the programs, who write back!) Far from passively watching television, students use the programming as a springboard to solve personal quandaries, create character webs, role play, produce artwork, and write essays for magazines. They read related literature and write about these stories, they participate in "hot-seat" activities related to the books and programs, and they get involved in collective video-shoots to share with others in participating schools. The range of learning activities helps students achieve the outcomes of the Ontario Common Curriculum.

HANDS-ON


GROUP DISCUSSION

S.N.O.O.P.S., like *The House*, presents 15 video dramas using young people involved in real-life puzzles. Themes relevant to different science disciplines form the core of the programming. The themes work well in an interdisciplinary science program and they can be supported with many hands-on/minds-on investigations:

- finding patterns as evidence
- doing experiments to describe and compare materials
- building and testing models
- tracking living action to relate form and function

All of the *S.N.O.O.P.S.* programs support the Ontario curriculum. They stimulate observing the environment, communicating ideas, comparing similarities and differences, organizing by various methods, and relating ideas to develop bigger ones. Besides concentrating on science-based themes, students seamlessly work across disciplines: they present findings, write about their explorations, create artwork, and produce group videos.

The 1995/96 Ontario Pilot

TVO piloted *S.N.O.O.P.S.* and *The House* in 10 Ontario boards of education with the participation of 20 classrooms (Grades 4 and 5). *S.N.O.O.P.S.* was piloted in Grade 5, and *The House* in Grade 4. TVO's demonstration pilot project was designed to evaluate the curriculum in a Canadian context and determine the design, format, and content of the television programs and classroom materials to be delivered when the project is fully operational in Canada. All activities during the course of the pilot project involved the whole school community, including staff, family of schools, trustees, and parents.

Participating Schools

TVO selected schools with a strong commitment to innovative learning experiences on the part of both teachers and principals. The participating schools agreed to use the Galaxy curriculum and resources for at least 30 minutes per day over the school year. In each school, two teachers were involved: one Grade 4 language arts teacher and one Grade 5 science teacher.

The pilot sites were selected on a province-wide basis. Urban and rural settings, student population, economic conditions, need, and overall student performance were among the factors considered. The following boards participated:

- Brant County Board of Education
- Bruce-Grey Roman Catholic Separate School Board
- Carleton Board of Education
- Dufferin-Peel Roman Catholic Separate School Board
- Hastings County School Board
- Lincoln County School Board
- Board of Education for the City of London
- Timmins Board of Education
- Metropolitan Separate School Board
- York Region Board of Education

Professional Development

Professional development for participating teachers and school principals is an integral component of this curriculum series. An intensive in-service took place in Toronto in October, with training provided by a team of leader/teacher practitioners from Galaxy (U.S.) and TVO's Distance Learning Division Education Community team led by Helen Coltrinari.

The symposium introduced the participants to the content and format of the television programs and their effective use in the classroom. Techniques focussed on how to create an interactive classroom atmosphere and to promote learning long after the television program has been viewed.

A second in-service session was designed for teachers and school administrators to share experiences at mid-point in the program, to explore strategies for the upcoming units, and to review techniques of time management, planning, and assessment.

Regular contact and support for teachers on an on-going basis was made available through a 1-800 line provided by Galaxy Classrooms and through fax and online services.

The Research

Galaxy Classrooms have been thoroughly researched in the U.S. through standardized measures, performance-based instruments, teacher interviews, classroom observations, and student interviews. Results have indicated that the Galaxy curriculum made a significant contribution to student and teacher involvement, motivation, and achievement (Guth et al., 1993, 1994).

TVO commissioned a research study from a team led by Dr. Terrance Boak, Dean of the Faculty of Education of Brock University, to carry out formal research activities to measure the impact of the pilot in the Ontario Galaxy classrooms. While citing some facets of the study which may affect results (timing, availability of instruments, rapid site selection, halo effect), the research team reported on the success of TVO Galaxy in the Ontario classrooms.

At the end of the 1995/96 school year, teachers were asked to complete a questionnaire on various aspects of the TVO Galaxy experience. With 19 out of 20 teachers responding, there was a large degree of consensus: the broadcasts, themes, and activities were consistently rated at the highest level. (See Table 1.)

Among other items, the research also measured the learning taking place with Galaxy, the relationship between Galaxy and the Common Curriculum, and the effectiveness of the professional development component of the program.

Learning Achieved with Galaxy Classroom

Pre-tests and post-tests were administered to participating students to help measure the learning achieved through the pilot period. "There was a significant difference in the degree of learning obtained by students in the Galaxy schools compared to non-Galaxy schools" (Boak et al, 1996, p. 62).

Language Arts Achievement

Students in the Galaxy Classroom achieved significantly higher improvement over time than the control group on the vocabulary subtest and on the combined test scores, but not on the comprehension subtest (Boak et al., 1996, p. 23)

Science Embedded Assessments

Theme 1: although only a small percentage of the Galaxy students were able to score at the highest level, approximately three-fourths were able to form integrated, plausible hypotheses based on observed patterns of evidence.

Theme 2: A high percentage of the students understood how models can be used to invent ideas and how designs can be altered to solve novel problems.

Theme 3: About four-fifths of the Galaxy students got the top score in the design and explanation of a machine developed in order to serve a functional purpose.

Table 1 **Galaxy Experience 1995/1996**

Language Arts (10 teachers completing)		
Galaxy Components	Educational Value of Component*	Students' Liking of Component
Galaxy broadcasts	4.00	4.00
Galaxy themes	4.00	3.90
Galaxy activities	4.00	3.85
Galaxy literature books	3.95	3.90
Science (9 teachers completing)		
Galaxy broadcasts	4.00	4.00
Galaxy "big ideas" for each arc	3.83	3.71
Galaxy hands-on science activities	4.00	4.00

* 4: High 1: Low

Theme 4: Almost 90 percent favoured using the skills of observation and/or scientific investigation in attempting to demystify unexplained phenomena (pp. 31–36).

On-site visits, process evaluation, and interviews took place throughout the year. Teachers commented on the gains their students had made as a consequence of the program (pp. 14, 36–37):

- I can see a difference in the level of interest and involvement in my students. I can also see academic progress, and what is more important, I can see evidence of transference of skills to other areas.
- Whenever you ask the students to take out their Galaxy folder they are excited. My students have become more tolerant of others and their opinions, which is a very valuable asset in today's society.
- What has happened is a great increase in the output the kids are doing and the amount of writing they want to do, and therefore the practice that they're getting.

The enthusiasm coming from the students is definitely making a difference in whether they enjoy coming to school and whether they're willing to participate and what they're looking forward to.

Common Curriculum Outcomes

A number of participating boards as well as Galaxy and TVO personnel identified the correlation between the Galaxy curriculum and the Ontario Common Curriculum. The exercise indicated strong connections between the objectives and activities of the Galaxy program and the anticipated student outcomes in the Ontario Common Curriculum (Boak et al., 1996, p. 37) However, "evaluation of students' progress with respect to Common Curriculum outcomes proved to be impossible to track.... For the most part, measurement of students' achievement of the outcomes was not yet being undertaken" (p. 38).

Effectiveness of PD Model and Its Components

The Brock researchers found that the TVO Galaxy experience had created a learning community among participating teachers. The teachers particularly appreciated the training institutes: "The training institutes held in Toronto ... were described by teachers as exemplary professional development experiences" (p. 62).

Table 2, from the teachers' end-of-year survey, illustrates the strong contribution of the professional development activities during the pilot period.

Table 2 **Staff Development, Pilot Period**

Language Arts / Science (19 out of 20 teachers completing)		
	Usefulness for Implementation*	
PD Activities	Arts	Science
October Institute at TVO	4.00	4.00
February Institute at TVO	3.60	3.55
Teacher newsletter	3.60	3.67

* 4: High 1: Low

A Look to the Future

TVO's Distance Learning Division has found in Galaxy a model of integration in which curriculum, professional development for teachers, and cross-disciplinary lines are blended. Research results and direct feedback from teachers, students, board superintendents, and parents have encouraged TVO to further develop the TVO Galaxy experience in Ontario. The 1996/97 school year will see the Grades 4 and 5 programs more fully extended throughout the province along with the addition of the primary program, *The Fixer-Uppers*. TVO's educators will be training many of the pilot teachers in train-the-trainer sessions so that they will be able to help other teachers in their regions learn to use the TVO Galaxy resources.

What Educators Say About the Galaxy Classroom

A sampling of citations from the meetings and interviews over the year may encourage readers of this article to stay tuned for more on Galaxy.

Principals and Vice Principals

- Teachers involved would love to do this forever, all day long.
- The program requires extra work for the teachers involved, but they love it and kids love it. Teachers can handle the workload — there's a big payoff. It's really been a positive experience for us.
- The professional development part of this program has been fabulous.... The enthusiasm that this has generated ... has continued through the year. The kids benefit as a result of that.

Teachers

- Galaxy is contagious.... Because of Galaxy, my kids are being encouraged to develop critical thinking skills.
- The program is just excellent.... The writing of my kids is vastly improved.... Every day it's getting better.
- Galaxy provides a real framework on which you can hang all of this fun stuff that really uses the higher order skills. And there's a reason to do this work to solve the mystery.... The stuff they're doing is not kid stuff. It's what scientists actually do.
- I think it's developed a love of learning.... One student said "S.N.O.O.P.S. is the best thing that happened to me in my life."
- I've really changed my teaching style. I'm two years from retirement and have found this one of the most exciting things I've ever done.
- [About a child with Attention Deficit Disorder]: Now he doesn't go to the office any more, he doesn't stand out from the other kids. He's right in the group. Nothing else has changed, he's had no change in medication. It appears to be the curriculum.

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What We Have Learned

Developing a Multiple-Media Curriculum Prototype for Grades 7 to 9

By GIULIANA COLALILLO

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ELANA D. GRAY

Research Consultant, Peel Board of Education

And RON WIDEMAN

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Nipissing University; Former Manager,
TVO Curriculum Project Manager, TVO

Part of the mandate of the TVO Curriculum Project was to develop and evaluate prototypes of curriculum products that incorporate a variety of technologies to support student learning. The Project team also conducted research on the effective use of technology to improve students' learning.[1]

One prototype, *Our Fragile World* (*OFW*), addresses environmental, problem-solving, communications, and technology-related learning outcomes. This multimedia curriculum resource kit enables students in Grades 7 to 9 to use video, print, CD-ROM, and floppy disc technology to identify and investigate environmental issues and develop multimedia presentations of their findings.

In early 1996, the kit was pilot tested in 11 school sites across Ontario, including urban and rural schools with greater and lesser access to technology, for periods of two weeks to five months. Data were collected through on-sight observation, focus groups, interviews, and a review of student and teacher project journals.

Two research reports were produced: one by TVOntario which analysed data from all school sites (Colalillo, 1996), another by the Research Department of the Peel Board of Education based on selected data from two Peel school sites (Gray & Favaro, 1996). These two schools were also part of a field-development partnership between TVOntario and the Peel Board to use the research results to inform development of an outcomes-based instruction and assessment package for *OFW*.

What We Learned

The two research reports contain a rich array of complementary and overlapping learnings about the *OFW* kit, its individual components, and its impact in the classroom.

Kit as a Whole

Teachers and students alike found that using the multimedia curriculum unit was a novel switch from the traditional paper, pencil, and poster approach. Teachers appreciated the opportunity to learn about and integrate technology in the classrooms. Their enthusiasm was reflected by that of their students who remained actively engaged and focussed throughout the project.

> The enormous potential that technology offers education can be harnessed by carefully developing curriculum units which seamlessly integrate the use of a variety of technologies.

Many pilot-test teachers referred to the kit as an "equalizer." It promoted equity of educational outcome in a number of areas. The flexible nature of the curriculum unit was seen as appropriate for all student learning styles, abilities, interests, and needs, with all levels of achievers successfully creating unique presentations. A number of teachers commented that girls, who traditionally tend to defer to boys when working on computers, showed little apprehension in working with all aspects of *OFW*, especially in classes where group roles were clearly identified.

Components of the Kit

Teachers felt that the individual components of the *OFW* package worked together well. They felt that providing both old technology (e.g., floppy disks, videos, printed teachers' guide) and new technology (CD-ROM, presentation software) components was essential for making the kit usable in a maximum number of classrooms.

Video — Students and teachers agreed that the 15-minute videos were an excellent starting point for investigating environmental issues and could be complemented with additional audio-visual resources, books, Internet databases, and so on. They also welcomed the attention paid to Canadian sites. Teachers noted that students still depend primarily on print resources to gather information. Students need to learn the skills of purposeful viewing, including the ability to extract and analyse information from video.

CD-ROM — Using the CD-ROM database and the presentation software to create multimedia presentations was the centrepiece of the *OFW* kit and it was a resounding success. Classroom observations and focus group discussions confirmed the remarkable motivation and interest shown by students working on multimedia presentations. The students' projects "came alive." Mac users found the ability to preview pictures, movies, sound effects, and music invaluable. DOS/Windows users wished for a similar previewing feature.

The most critical issue around the use of the CD-ROM was access. Dividing students into groups eased the strain in classrooms with access to only a few computers, so did multi-tasking the project so that groups of students could rotate in and out of computer centres. Where there were multiple computers, the issue became how many CD-ROM discs were available. The prototype kit included one, but many sites requested additional copies.

Teachers' Guide — The teachers liked a number of sections in the teachers' guide — for example, the list of learning outcomes that the kit would help students accomplish (as set out in the MET Common Curriculum document), the graphic overview of the sequence of steps for using *OFW*, the information on storyboarding, the synopses of the videos, and the bibliography.

Teachers agreed that a teachers' guide was needed but emphasized that they did not want either "masses of print" or a prescriptive "step-by-step cookbook." They used the guide in different ways: scanning for the "big picture," reading to stimulate or confirm ideas, looking for help to get started, or finding information about the videos. Few teachers referred to the brief section on assessment and evaluation, demonstrating a need for increased emphasis on this aspect of teaching in the guide and in Ontario education generally. There was also a strong suggestion that the guide should be available both in print and electronic formats.

Resource Catalogue — Some classrooms used the resource catalogue extensively to help students identify pictures and movies from the CD-ROM to be incorporated into their multimedia presentations, thus saving valuable computer time. In other classrooms, the catalogue was not used at all, and the previewing and selecting of the multimedia resources was done directly on the computer. The approach used did not appear to depend on the availability of hardware but rather on the instructional approach and outcomes selected within individual classrooms.

The Our Fragile World prototype included:

- four, 15-minute video programs that raise environmental issues — *Khutzeymateen Valley, Clayoquot Sound, The Rainforests of Costa Rica, and the Whales of Patagonia*
- a list of print and Internet resources to support investigation
- a wide variety of pictures and quick-time movies from the four video programs as well as music, sound effects, and backgrounds (These resources are on CD-ROM and floppy discs. They enable students to develop multimedia presentations of the results of their investigations. The CD-ROM is cross platform, being usable on both Macintosh and Windows machines.)
- a simple to learn, presentation software package
- a resource catalogue listing all the still photos, movies, sound effects, and music available on the CD ROM and floppy discs
- a teachers' guide with technical specifications, learning outcomes, and some teaching ideas for viewing, investigating, and storyboarding
- packaging in kit form so all the components are readily available to the teacher

Presentation Software — The eleven test sites used three different presentation software packages on either Mac or DOS/Windows platforms. Teachers and students agreed that the distinguishing feature of the OFW kit compared to other resource databases was the ability to produce a multimedia presentation. Teachers recommended that entry-level software approved by the MET be included in the kit. They felt that selecting more complex presentation software should be left to individual teachers/boards of education.

Impact on the Classroom

Teachers indicated that the non-prescriptive nature of this multimedia curriculum kit provided them with flexibility and freedom to develop a classroom curriculum that suited the learning needs of their students and their personal teaching styles. Indeed, a number of best-practice strategies were consistently implemented in the test-site classrooms.

Cross-curricular Approach — Teachers found that the *OFW* curriculum unit provides ample opportunity for integrating the four different program areas — The Arts; Language; Mathematics, Science, and Technology; and Personal and Social Studies. Interestingly, the Grade 9 teachers felt somewhat handicapped due to the demands imposed by the subject-based high school timetable and the "drive to get kids to cover subject content and competencies" which typifies the high school agenda.

Co-operative Learning — Test sites invariably organized students into small working groups to carry out projects based on themes or issues arising from the *OFW* kit. Teachers consistently noted the collaboration and team work among the students throughout the project. The variety of project tasks and responsibilities provided students with excellent opportunities for skill development (e.g., organization, communication, problem-solving, social, and co-operative skills) as they worked towards a common goal.

Process-oriented Learning — Teachers noted that the *OFW* curriculum unit engaged students in an investigative process that was, in itself, educationally valid and rewarding. Many teachers concluded that the learning process itself was even more important than the final product — the multimedia presentation. In addition to the multimedia components, teachers used a variety of supporting activities, for example, research, poetry, personal journals, storyboards, field trips, and experiments.

Technology-rich curriculum units need to be flexible and adaptable so that teachers can tailor their teaching strategies to the learning styles and needs of their students.

Collaborative Investigation by Teachers — In the majority of test sites, the key to successful classroom implementation of the *OFW* kit was collaboration among the teachers involved. Regular group discussions, brainstorming, trouble shooting, and information sharing were viewed as essential. Teachers who had the opportunity to collaborate with their colleagues found the experience to be enriching and rewarding, thereby enhancing their students' learning and their own professional development.

Implications

The development and pilot testing of the *Our Fragile World* prototype has implications for the successful incorporation of technology into school programs.

- The enormous potential that technology offers education can be harnessed by carefully developing curriculum units which seamlessly integrate the use of a variety of technologies to achieve learning outcomes (see Colalillo, 1995).
- The key to successful use by teachers of such units in schools is in site-

based collegial collaboration augmented with in-person, telephone, and technical support; these activities result in significant program improvement and teachers' professional development.

- Technology-rich curriculum units need to incorporate older and newer technology components and thus be of use in classrooms regardless of technological expertise or access; such kits have the potential to "bring teachers along" in incorporating newer technologies into classroom use.
- Technology-rich curriculum units need to be flexible and adaptable so that teachers can tailor their teaching strategies to the learning styles and needs of their students (see Soudack, 1996). Technology has enormous potential to enable all students to achieve the learning outcomes of Ontario's Common Curriculum. This potential will not be realized through "lock-step, teacher-proof" curriculum. The professional decision-making capabilities of teachers must be encouraged and enhanced.

NOTE

[1] To date TVOntario Research has produced six reports in support of TVO's initiative to revitalize its curriculum programming: Colalillo, G. (1996). Impact of educational technologies in students and teachers. Toronto: TVOntario Research; Colalillo, G. (1996). Evaluation of Our Fragile World multimedia kit for grades 7–9. Toronto: TVOntario Research; Davis, D. (1995). Summary of findings: Evaluations of curriculum programming. Toronto: TVOntario Research; Jones, R. (1995). From broadcast television to interactive multimedia: Repurposing and multimedia design. Toronto: TVOntario Research; Soudack, A. (1996). Multiple intelligences, learning styles and interactive media in education: A literature review. Toronto: TVOntario Research; Stern, J. (1995). Television and video in the classroom: A review of survey findings. Toronto: TVOntario Research.

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New Meeting Grounds for Collaboration and Inquiry

Using Internet Services and Electronic Networks in Secondary School Social Studies

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Our society is in the midst of massive social and cultural change, driven to a great extent by computer technology and the information revolution. This shift is having a critical impact on those in the field of education as they rethink and reconstruct what it means to prepare students to function effectively in today's and tomorrow's society.

Provincial education ministries and professional teacher organizations are stressing the potential and significance of computer technology in the emerging educational agenda. *The Common Curriculum* identifies the effective use of technology as one of the "Ten Essential Outcomes" while the recent Royal Commission on Learning describes it as the "fourth engine" of change.

> Computers are the evidence that schools have some real connection to the outside world, that schools matter, that they're relevant, that they're part of the whole reality of childhood. This is not a contribution to be scorned. In a world of super Nintendos and kids who can set their families' VCR clocks, where half of all homes will soon have their own computers, it is only too easy for traditional schools to seem beside the point. That's what UNESCO means when it reports that "teachers armed with chalk and a blackboard are no match for the powerful new media." Computer literacy is already the new basic.... (Royal Commission, 1994, p. 19)

Regardless of one's personal beliefs and feelings about the uses (and abuses!) of computer technology, it is infiltrating schools on many fronts for a variety of purposes. Educators are being introduced to a range of opportunities for transforming instructional practices on the one hand and being confronted with an assortment of challenges on the other. How and to what extent computer technology will be used is still open to question. This article will describe some of the ways we have used computer technology — primarily the Internet and electronic networks — to support teaching and learning in secondary social studies programs. As well, this article will offer some of our subsequent observations about opportunities and challenges associated with these types of applications.

Exploring the Options

Both authors came to this technology as adults, one as a child of the "Pong Generation," the other as a child of the "pre-Pong Generation." We both have always had an interest in finding effective ways to approach learning, and as computer technology became a realistic option, we jumped in — sometimes with support and the requisite knowledge and skills, more often without.

For one of us, exploration into the use of computer technology in the secondary social studies curricula began while teaching in the mid-1980s, with a review and assessment of computer-aided instructional software applications (Evans, 1986). For the other, exploration of computer applications for the social studies curricula began while in the pre-service year at the Faculty of Education, University of Toronto in the early '90s. A foundation of knowledge and skills with e-mail, discussion groups, the Internet, and first-hand curriculum experiences using computers in an archaeology program on a special artifact-cataloging research project had already been established.

For both of us, opportunities to increase personal awareness and to tinker with these new technologies grabbed much of our attention in these early stages. Next, we became interested in the impact these technologies might have on teaching and learning and began to explore more sophisticated and authentic computer applications as we worked with both students and colleagues. We found our prior focus on software applications within the classroom shifted to a focus on electronic networks and the Internet, applications that could encourage collaborative problem-solving and inquiry. It appeared to us at the time that electronic networks provided opportunities for online conferencing while the Internet enlarged these capacities by providing an exciting range of information services including databases, news groups (USENET), electronic mail (e-mail), the ability to connect to and use remote computers (Telnet), and the World Wide Web.

> We found our prior focus on software applications within the classroom shifted to a focus on electronic networks and the Internet, applications that could encourage collaborative problem-solving and inquiry.

Arab-Israeli Simulation

An early example of an application that emphasized collaborative problem-solving that one of us was involved with was a pilot project at Streetsville Secondary School in the late '80s known as the Arab-Israeli Conflict Simulation, an interactive communication simulation involving Grade 12 history/politics students and students from 11 other schools from around the world. The schools were organized into 11 country teams with members of each team being assigned various roles including a foreign minister, defence minister, a major newspaper reporter, and others. An e-mail network, co-ordinated through the University of Michigan, was integral to the communications among schools (ics.soe.umich.edu).

The intent of the simulation was to immerse students in the complex web of international relations. Students were involved in a variety of tasks. As participants in the domestic political affairs of their assumed country, they worked to research and map out realistic responses and strategies to events as they emerged in the press or through other countries' actions. With the other classes in other parts of the world, they were involved in a range of computer-mediated activities that involved negotiations, the sending and receiving of private diplomatic messages, and the development of resolutions for peace (Bebensee & Evans, 1990).

The students reported that they found the experience both rigorous and rewarding in heightening their awareness of and appreciation for the challenges of the Middle East situation. In addition, they appeared to gain an important understanding of, and the skills associated with, communicating "at a distance," the function of diplomacy, and the value of conflict-resolution strategies.

G7 Summit

An example of an application that emphasized inquiry that one of us was involved with was an investigation into the G7 developed at Glenforest Secondary School. Students from OAC economics, politics, and two classes of world issues were each assigned to role play one of the G7 countries. Over a three-week period, the students met outside of class time to examine the research topics in preparation for the simulation of a real G7 summit.

The resources of the Internet formed an integral part of the inquiry. Normally, conventional print and media sources on the G7 aren't available until after the summit, unless you know someone associated with the event. Now, the G7 countries use the World Wide Web to publish information before the event. As well, universities which study the G7 also make their research available. Because of Web access, students were able to gather up-to-the-minute information from both the country Web sites and the G7 Research Group at the University of Toronto (utl2.library.utoronto.ca/www/g7/index.html.).

On the day of the summit simulation, the students travelled to the Peel Board of Education office to hear a keynote address and to hammer out their country's position statements based on information collected primarily from the Internet. They found the experience frustrating and demanding. It proved difficult to reach consensus while protecting the interests of one's country. Student feedback on the project was overwhelmingly positive — in fact, they asked that subsequent simulations spread over two to three days as they were "just getting into it" when it was time to go home.

American History Project

In another Web-related project, the American history class at Glenforest routinely uses the Web to examine the relationship between the media and the executive branch of government. Because all the current releases and wire-press interviews made by the White House are on the White House Web server (www.whitehouse.gov) students are able to compare the press releases with what is actually published in the print and broadcast media.

These budding political scientists learn valuable skills regarding the detection of bias and the technique of "spin-doctoring" as they formulate questions which they would ask the President or the press secretary if they were White House bureau reporters. More recently, the students followed the granting of Most Favoured Nation status to China by analysing the full text of one of President Clinton's speeches on the subject. The students were particularly concerned by the scarcity of attention paid to human rights issues, the apparent contradictions in the U.S.'s treatment of China and Cuba, and the lack of reporting of these issues by the major U.S. news services. Both in this and the G7 projects, the resources of the Internet formed an integral part of the inquiries.

Another part of the American History Project involved a teacher/student link with East Pictou Rural High School in Nova Scotia and Hammand Middle School in Virginia. Senior American history students at East Pictou worked as electronic mentors for Grade 8 students in Virginia and, using National Archive sources, studied the impact of the American Civil War on Confederation. Students at Glenforest conversed with these two schools to share the research on the Civil War.

UNITE Portfolio Study Group and the OISE/UT History/Social Science "Talk" Conference

We also found that electronic networks and Internet services offer interesting opportunities for educators to "meet online" to discuss instructional questions. Two years ago, a group of history and social science educators from across the Toronto area established a study group with the support of The Urban Network to Improve Teacher Education (UNITE) to investigate the use of portfolios and the implications of implementation.[1] Our group included six teachers from different secondary schools from boards in the Toronto area, two pre-service candidates, and two faculty members from the University of Toronto's Faculty of Education.

The learning orientation emphasized inquiry, and "conversations" took place primarily over a one-year period in two formats — through our scheduled meetings and on the Teacher Education Network (TEdNet). This electronic-conferencing network and e-mail system allowed us to establish a private conference in which we could carry on private conversations from our meetings, discuss concerns that arose, and share our thoughts from our research and classroom experiences with portfolios. While it assisted in our conversations, it primarily opened our eyes to the potential opportunities for professional learning that can result from this medium, particularly for those of us interested in talking with others with similar interests but are in distant locations and have crowded schedules. To this day, the original members of that group continue to converse about a range of themes and issues of importance to teaching and learning.

In the last year, we have been exploring the potential of electronic talk conferences as a tool to support professional collaboration and inquiry with our pre-service candidates and associate teachers at OISE/UT. Essentially there are sub-conferences to support pre-service candidates' inquiries ranging from a focus on classroom practices to the identification and selection of useful Web sites. Questions and concerns are posted for others to respond to based on personal experiences and ongoing research. Currently we have about 150 pre-service candidates involved in the conference with a growing number of teacher associates. While it is very much at the preliminary stage, responses have been quite positive and we are seeing some interesting opportunities emerging for online inquiry and collaborative problem-solving.

Education Technology at OISE/UT

Distance Education

OISE/UT also makes use of education technology in its attempts to meet the changing requirements of its students for access to courses and programs. A wide variety of courses is available through both computer mediated conferencing and audio conferencing modes.

The availability of distance education courses makes it possible for students to continue their studies while working at their jobs on a daily basis. Beyond that, students are able to carry on with their studies from points across Canada and around the world. Students in New Zealand and Malaysia, for example, are presently participating in OISE/UT distance education courses. Similarly, other students are located geographically from points in British Columbia to Newfoundland and north to the North West Territories. Linkages are made with the central computers at OISE/UT through the Internet by means of telephone lines, satellite connections, and local Internet service providers. Others connect to OISE/UT directly by telephone.

Besides allowing students from all parts of the globe to participate in courses, computer technology also makes it possible for them to engage in learning activities at times most convenient to them. Besides work, demands of family life and other responsibilities mean that distance education students cannot always be available to attend class at set times of the day or week. With computer mediated courses, this is not a problem. Computer conferencing "classrooms" are available 24 hours a day, seven days a week Students are able, therefore, to tailor their study and class participation times to suit their personal schedules.

While the use of technology to enhance the program offerings does have some limitations or drawbacks and might not fit the learning styles or preferences of all students (or teaching style and preferences of all instructors), it does provide a means for an increasing number of students to make learning a truly life-long activity and not just something which occurs in places far from home at particular times of the year.

For more information about OISE/UT Off Campus Programs, please call …

(807) 475-8110 or
e-mail wseller@oise.utoronto.ca

Observations From Our Early Involvement

Often teachers feel uncomfortable with computer technology; they look at those who are actively using it and think "I'll never be there." With over ten years of tinkering behind us, we still feel this way as computer technology continues to transform itself at an intimidating rate. At the same time, however, our modest beginnings have provided us with a window to view students' and teachers' interest through and a commitment to learning in computer-mediated environments and to considering the opportunities associated with these technologies for teaching and learning in secondary social studies programs. Some of these include:

- instant access to a substantive information base to investigate real issues of historical and contemporary relevance not readily available in the traditional school setting; information available via the World Wide Web not only extends existing possibilities by allowing the students to find current research or material on a topic but also seems to open up completely new areas of study (the Web provides research from multiple sites and from world experts with up-to-the-minute data)[2]
- an authentic context in which to enhance one's personal inquiry strategies and perform the skills required of historians and social scientists to select, analyse, and assess a range of source material, and communicate findings (the process of finding and selecting source documents appears to give students more control over their own inquiry process and personalizes their learning experience)[3]
- a more capacious medium in which to

- collaborate and encourage dialogue; students and teachers from diverse locations with different knowledge and experiences are able to compare their research and experiences in the resolution of various questions, problems, and issues thereby enriching the discussion and ensuring multiple perspectives well beyond the classroom walls;[4] furthermore, we sensed that this sharing of ideas and research with others gives "voice" to those involved
- a sense of international connectedness; everyday, students and teachers using the Web in Canada travel internationally (once users understand how to read the country codes in the Uniform Resource Locators, there is an interest with whom one is connecting. For students in particular, they discover, often by accident, that time zones really do exist, that people write and speak different languages, and that people in other countries often care very much about the same issues as the students themselves. The world becomes much more manageable for the mind to grasp when one is having a real-time conversation with others in Singapore or in Belgium.)

From our "small steps," we believe that these types of computer applications provide many exciting opportunities for teaching and learning in secondary school social studies. The extent to which these opportunities will be realized, however, will depend on our capacities as educators to act upon these opportunities, at both the personal and institutional levels, to integrate these technologies wisely throughout the core of our systems, not just the periphery. We note many challenges.

One critical challenge will be to continue research into and experimentation with how best to integrate these technologies with robust and differentiated learning strategies to capture the full benefit of these technologies for student learning. As Alan Sears, Gerry Clarke, and Andrew Hughes (1996) suggest in reference to teaching and learning in the social studies that "we must be certain that we do not remove or replace the 'social' in social studies by a less than thoughtful use of technology … the key to [its] ultimate use or abuse still rests in human relationships, in the interactions between teachers and students …" (p. 15).

Another critical challenge will be to establish ongoing professional learning and support options. We have found in our own experience that the integration of these new technologies tends to augment a more student-centred and inquiry-oriented approach to teaching and learning — a significant shift from current practices. Support for professional learning will require at a minimum a dual focus, one that blends the development of computer literacy skills with one that considers the implications for current instructional practices. In this way, educators would be equipped with the necessary capacity to use these tools more effectively in their classrooms as well as provide meaningful input into decisions regarding the use of technology in schools, a voice that to a great extent has been missing in the broader policy-making process.

Support for professional learning will require at a minimum a dual focus, one that blends the development of computer literacy skills with one that considers the implications for current instructional practices.

What will we be doing? We will likely continue to extend our "meeting grounds." We will likely get more involved in collaborative efforts with students and teachers in other parts of the country using Canada's Schoolnet as the vehicle for this endeavour. We will probably investigate the use of schools' internal Web sites to create a learning community which extends far beyond the doors of the building and seeks out grass-roots community involvement and support. And we expect to spend some time exploring this technology as a catalyst to enhance international collaboration and to support inquiry-based professional learning.

NOTES

1. The Urban Network to Improve Teacher Education (UNITE) is a network of schools and colleges of education in urban settings in the United States and Canada dedicated to educating teachers to teach successfully in urban schools.

2. Archive sites and online exhibits, for example, offer students the opportunity to supplement texts and other print sources and to take multimedia tours of famous institutions. The quality of these sites is excellent. The Web sites are compiled in much the same manner as actual exhibits, by qualified researchers and museumologists in the field. The Canadian National Archive (www.archives.ca.), the Canadian Museum of Civilization (www.cmcc.muse.digital.ca/cmcchome.html), the Louvre (mistral.culture.fr/louvre/), ROM (www.rom.on.ca), the Library of Congress (sunsite.unc.edu/expo/1492.exhibit/Intro.html), and others offer exceptional possibilities for inquiry.

3. A personal primary-source favourite of the authors is the Library of Congress's archive of Civil War photos taken by Matthew B. Brady (rs6.loc.gov/cwphome.html). This collection makes possible the creation of lessons around the whole issue of bias in textbooks. Students can search through the Civil War photo archives, study other sources on the war, and compare their research with what was ultimately selected to appear in their textbooks.

4. The government of Canada (info.ic.gc.ca/opengov/) sponsors a project known as Schoolnet (www.schoolnet2.carleton.ca) which is an electronic meeting ground for teachers and students across Canada. Teachers can propose projects on Schoolnet and liaise with other interested educators across the country. Projects can and do include comparative local history and issues forums around a range of public policy issues. You can also find E-STAT (Statistics Canada) on Schoolnet.

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The "Other Story"

A Telecommunications Journey into the World

By ALNAAZ KASSAM

Senior Research Officer, OISE/UT

Trying to understand the impact of technology while being surrounded by it is a little like being an ant in a rain forest about to be destroyed. As I try to step back from this environment and return to a time when technology played a lesser role in my life, I find myself in a history class in Africa. With the rain coming down on the corrugated iron roof, the smell of the rich, fertile soil wafting in through the window, I am listening to the drone of my history teacher — an expatriate Englishman from London — as he narrates the voyages of discovery. The climax of his tale is the discovery of the sea route to India.

At that moment, I raise my hand and say: "But sir, we always knew the route to India. Africans and Indians were trading for centuries before the Europeans came. How could that route have only been discovered in the 19th century?"

To calm my concerns, from that day on, the history teacher changed "X discovered Lake Victoria" to "X came upon Lake Victoria" or "X came upon the source of the Nile."

Though my history teacher was becoming more reflective, and considerate, when I left school, I learned that the media, textbook authors, documentary producers, and writers of fiction would not understand my concerns. In fact, since leaving high school, my long discovery of being the "other" has unfolded without interruption.

Technology or no technology, some parts of the world (Asia, Africa, the Middle East) would always be "other." In fact, increasingly over the past 20 years, technology has continued to serve the viewpoint of those who possess the technology — the North Americans and Europeans. For example, to be considered objective and impartial about the Gulf War, one had to be an American, British, or Canadian journalist — one could not possibly be Iraqi. To understand the religion of Islam, one had to be an unbiased and objective professor in North America — one could not be Muslim.

In discovering the "me" that was continually being defined by the majority, I learned things about the media. Newspaper journalists, who by night suffered in the trenches of war in the Middle East or Bosnia or Rwanda but whose words appeared unfailingly on my breakfast table the next morning, could only portray the Other from their own perspective. This perspective would remain the same no matter how sophisticated the technology. Over the years, I began to wish for a moment when the other could be heard above the din of the technology.

That moment finally came. Three years ago, I, along with Rina Cohen and Brian Durell as co-principal investigators, acquired funding from the Ontario Ministry of Education and Training to develop a project called the "Other Story." It was a chance not only to take the nascent Internet technology into the classroom but also to bring with it the voices of the Other. The first culture to be studied was the Caribbean and the second was the First Nations. In the project's two year history, students participated from Ontario, BC, Manitoba, and Barbados.

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The most important objective of the project was to study cultures from their own perspective. All materials used in the project were developed by the people of the culture involved and not by outside "experts." Students, teachers, writers, and professors of the culture were invited to participate in an on-line conference which linked students across Canada to each other.

We envisaged that through this approach Canadian students would develop a deeper, more issue-centred and less media-bound understanding of different cultures of the world. For example, when the students participated in a simulation to discuss the impact of global TV on the Caribbean, the "Ministers of Tourism" read, among other things, an article which detailed how much of each tourist's dollar is actually spent in the tourist's home country — on the airline ticket, on the hotel owned by the airline, and on food which is bought overseas to be consumed by the tourist during his visit — before the tourist even gets to the Caribbean.

The students also watched a film called *The Dish Ran Away With the Spoon*, in which the director of the film visits Cuba. Although the film maker laments Cuba's poverty, he feels that at least the Cubans have been able to keep their culture, whereas in his own country he is bombarded with images of snowy weather forecasts on CNN and episodes of the "Young and the Restless" soap opera.

For me the Other Story was a unique opportunity to enter the world of another culture, to hear about its pain and its joys, its view of itself and of its own history. It was a very special moment when we studied the First Nations peoples from the perspective of a story written by Susan Fletcher, a First Nations author. The story was about Mistahimaskwa, a Cree chief, who is committed to working towards the preservation of his people, their land and their culture, and who loses his life in the process. The story seemed particularly poignant when Cree students from a school in Northern Manitoba shared with us their pain at having their land flooded by Manitoba Hydro; they now must live in a new town, having lost their traditional hunting and fishing grounds. "The story of Mistahimaskwa is our story; nothing has changed for us," they said.

What did the Other Story present that had not been there before? The Other Story project for me was a chance to vindicate that moment in the history classroom when my story was not important, when I was an object of history and never an actor within it.

What did the Internet provide for students in Canadian classrooms that a teacher could not? The Internet provided an opportunity for the Other to come simultaneously into many classrooms, to tell his or her own story, in words that brought meaning. It allowed students to debate real-life issues concerning communities today. Most of all, it allowed students to interact with the Other directly — posing questions, discussing issues, and receiving feedback on their views.

> The Internet provided an opportunity for the Other to come simultaneously into many classrooms, to tell his or her own story, in words that brought meaning.

The Internet provided a window into many classrooms, a chance to see many students and people of different cultures — to learn about their concerns, problems, and limitations — with a speed and all-at-onceness that seemed overwhelming. The Internet is a tool that can bring equal access and so can provide a platform for so many who may have found it difficult to find a place in which to be heard and understood.

What did the Internet not bring? Through the Other Story I learned that students were not ready to see the Other as anything but the "other" in a stereotypical manner shifting from pity to fear to disdain to romance. And I discovered that technology, no matter how beautiful, how glossy, how overpowering, cannot replace a good teacher, a good human being, a good story, a good journalist who sees the Other not as the “other,” but as a human being — complex but compassionate, with all the desires, hopes and ambitions of all Canadians.

What now remains is the task of educating the audience — a task that will never leave us, no matter what gadgets and technologies we introduce into the classroom.

A Computer-Based Music Curriculum

Experiencing and Understanding

The software program we use works like a sophisticated multi-track tape recorder.

By PEGGY MACINNIS

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Scarborough Board of Education

The software program we use in my music classroom is called Musical Instrument Digital Interface, commonly referred to as MIDI. It enables the learner, as computer user, both teacher and student alike, to experience a holistic approach to learning music. MIDI is a digital communication standard which translates music from notes and symbols into computer bits and bytes, and vice versa. This is done through a special type of cable system and connectors linking the computer and musical instrument(s). The most common set-up of this musical tool consists of a computer and a synthesizer which do not work on their own but rely on the musician/creator/performer to complete this musical chain, by actively using or playing these musical instruments.[1]

The software program we use is called Musicshop (Opcode) which is a music composition/sequencing program, working very much like a sophisticated multi-track tape-recorder. Having 128 different instruments to work with, the program can record what the student plays on the synthesizer up to a total of 16 different tracks. Upon playback, the composer’s musical ideas are instantly displayed on the computer screen in either standard notation using treble and bass clefs or in graphic notation, depending on the user’s preference. Editing is easy, enabling the user to concentrate on his or her own creative ideas rather than on equipment manipulation. The interface is simple to use, with on-line help instantly available at the touch of a button.

This interdependent nature of computer-music environments and tools allows for learning in the context of meaningful and authentic activities in the music classroom, bringing together for the first time the three musical components of creating, performing, and listening.

Musical experience is no longer restricted to the talented few but is accessible to all. MIDI does not place any restrictions on learner capabilities — physical or mental. Rather than being restricted to the physical mastery of, for example, one wind or string instrument, the focus in my music classroom has shifted to the student and to the development of his or her own musical intelligence. Previous musical barriers are now removed, and all students can be provided with a musical tool of excellence, with emphasis on the quality of the experience, on the meaningfulness of what is to be learned.

"The primary focus in implementing the holistic curriculum is on teacher personal growth" (Miller, 1993, p. 138); therefore, the acquisition of knowledge of MIDI for educators needs to be addressed. Unfortunately, the majority of music educators who are currently teaching received their formal teacher training during the pre-MIDI and pre-computer technology era. I believe we need to live at the time we live and extract the full meaning of the experience provided by computer technology.

Rather than being restricted to the mastery of an instrument, the focus has shifted to the student's "musical intelligence."

Composing and Journal Writing

My students spend their entire class time either composing at the computer or learning keyboard repertoire from the method book KeyRead (Warner, 1988). My students rotate using the nine computer workstations so that everyone gets equal time composing. Our long-term goal includes replacing the 16 stand-alone keyboards with music computer workstations, eventually bringing our total to 25. I structure each class so that we listen to one piece of music each day, which is brought in by a student. Students actively take part in the discussion which follows, and a link to their own composing experiences is made.

While composing, students are encouraged to write down their thoughts and actions. We try to capture in words our experiences, clarifying our perspectives on what we have just done, as well as responding to previous questions and thoughts from myself or the class. They complete their journal for homework and give it to me the next day on paper or e-mail it either to the music conference bulletin board, which I monitor, or to my private e-mail box. By working collaboratively with my students, our understandings of musical insights and experiences develop and deepen. Being able to tap into the thoughts and reactions of my students on a daily basis is like having a thermometer for my classroom and curriculum. I know my students much better and can provide them with a curriculum which better suits their needs.

Second to composing, journal writing is the most crucial ingredient of my curriculum. Writing is like putting on composing glasses, providing a way of seeing inside the composer's mind. Writing permeates everything we do in the classroom, providing a unifying thread. The time the actual writing requires slows down the thought processes so that each idea can be captured, focussed on, distilled, and looked at from various perspectives. As

My students spend their class time composing at the computer or learning keyboard repertoire.

one student wrote, "Writing helps you articulate what you are doing musically" (Meri). Other insightful thoughts from my students' journals include:

- It was like as soon as I put on those headphones I was in my own world. No one could hear me, but me. If I made a mistake or messed up in a song I could laugh at myself and not have anyone do the same. Now I feel more powerful. You know what they say "Knowledge is power." Well, today I really felt that. I'm very glad that you made a journal a part of our daily learning. I didn't know how many thoughts were in my head on this particular subject. I could go on and on. (Courtney)
- I love to be creative and there are so many different ways to do so — such as talking, writing, drawing, designing and a creative way of playing music. I also love being creative in my writing which is also a very important part of music. Because like Mrs. MacInnis says, the more you write the more you learn. And I think that that is true. When you write a paragraph about anything — life, death, songs, pizza, anything you will learn because words you never knew you never knew will come out on paper and you'll be like, wow, I just learned a different style of sentence writing. I'm learning something write [sic] now. (Courtney)
- Everything just started flowing naturally. It was as if I wasn't even doing the work. My fingers just started dancing on the keyboard and whichever sounds I heard were exactly the ones I wanted. I had finally broken through the walls I had built around myself. (Mandhir)

Creating, Not Re-Creating

My students have taught me many things, many contrary to what I had been taught, including that my music curriculum needs to be based on sound or ear education rather than sight. Emphasis is placed on sound exploration rather than on reading abilities. Our curriculum focusses on creating instead of re-creating. I have learned that standard notation is not necessary in order to understand music. Rarely has there been a need for me to teach my students how to read the standard bass and treble clef notation, and we no longer use such things as the metronome, metre, time signature, and even the names of the notes.

Painting with sounds is an important metaphor that enabled me to deepen my understanding of ear education, of listening and hearing versus seeing. Since the wide array of sounds available with the music computer workstation is like a palette of paints, with one colour for each sound, multiplied by the number of keys, there is a seemingly infinite number of sound possibilities which the composer can instantly access. A parallel can be drawn between the early childhood experience of painting and that of creating a piece of music. What the child can intuitively do with paints, she or he can also do with sounds. I therefore nurture my students' musical development through a logical progression of steps, starting simply and providing ample exploration opportunities. These we share with the rest of the class on a regular basis. We have recognized that the experience comes before the traditional rules can be taught. Experience is the teacher.

> "... as soon as I put on those headphones I was in my own world. No one could hear me, but me. If I made a mistake or messed up in a song I could laugh at myself and not have anyone do the same ..."

My classroom now resembles a student-centred hive of activity. I no longer put up false barriers, establishing arbitrary due dates for the completion of assignments. Instead, students work at their own rate. Emphasis is placed on process rather than product. The students' Process Portfolios, both their journal and computer disk, provide a wealth of information for evaluation purposes. Although the class officially begins at 8:55 a.m (once every four days), my students arrive as early as 8:00 and immediately get to work, stopping only to stand at attention for the National Anthem. This never occurred with my non-MIDI classes.

As Kratus (1994) advises:

> Our challenge as music teachers is to help our students bring their songs to light, so that creative music-making becomes as natural to our students as speaking and writing. We should endeavour to do this for the enrichment of their lives. And for the enrichment of our own. (p. 140)

Through collaborating with my students, I have begun to develop an understanding of what a computer-based music curriculum could be. Adapting the words of Lincoln and Denzin (1994, p. 98):

> We know now that the old music curriculum will no longer do.... But the new curriculum is not yet in place. And so we look for the pieces of the curriculum, the ways of telling it through composing and journalling, and the elements that will make it whole.

I encourage more teachers to begin collaborating with their students in order to reveal the new music curriculum: the computer-based music curriculum.

After giving a music computer workshop recently to music teachers of the Scarborough Board of Education, one teacher reflected, "You must really look forward to coming to school each day." She is right. A computer-based music curriculum offers many rewards to teachers and students alike.

NOTES

The author wishes to thank C.T. Patrick Diamond of OISE/UT for his inspiration and assistance in my thinking and writing about music curriculum.

1. My initial curriculum transformation began during my Ed.D. studies. For further in-depth information on Computer-Based Music Curriculum see: MacInnis, P. (1996). *Experiencing and understanding a computer-based music curriculum: A teacher's story.* Doctoral thesis, OISE: University of Toronto. (also available on CD-ROM)

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Building Skills for the Next Century

Bringing Contemporary Technology into the Classroom

By MIKE MILLER

Principal, Turner Fenton Campus
Peel Board of Education

Turner Fenton Campus, affectionately known as TFC, is a secondary school of 2000 students in Brampton, Ontario (The Peel Board of Education). Besides regular programming for Grades 9 to OAC, TFC offers an extended French program, a vocational program, and a regional aviation program. Also it is the regional enhanced-learning centre for the city of Brampton.

At TFC we are trying to bring contemporary technology into as many classrooms as possible. I hope that some day it will be as ubiquitous around our campus as it is in the world at large.

Permit me to begin with a personal anecdote. Recently, I was invited to tour a small Burlington firm which specializes in geographic information software applications which they market around the world. I met one young woman, a mere four years past her high school graduation, who took me on an electronic "fly-over" of a closed uranium mine in the former East Germany. The German government has begun a 20-year clean-up of the site and has commissioned this firm to create an ongoing visual diary of the rehabilitation effort. Using only satellite-imaging data purchased on the open market, she showed me on her monitor a "flight" into the pit, under a railway bridge, up over a mountain of tailings, and back around to the nearby town. Gigabytes of data rearranged themselves in a twinkling so we could look left or right, up or down and "see," for any epoch in their database, every corner of the former mine. Most amazing to me, however, was how utterly blasé my young pilot was, as she manipulated this technological marvel.

The 386 personal computer on which I am typing this article is many times more powerful than the University of Toronto's 7094 computer on which I did my graduate research, and that behemoth would have filled half of that Burlington firm's floor space. And yet a 386 is now universally viewed as primitive. If the world has changed that much in my adult lifetime, how can schools possibly not change? How can a Grade 10 geography class fill in maps with coloured pencils rather than manipulate GIS data bases?

At Turner Fenton we received two rounds of technology renewal funds from the Ministry. The 1992/93 grant mostly went to establish a communications laboratory. With a lot of painting, cleaning, and hammering by staff volunteers and a number of gifts from the school's corporate partners (some paint, some cash, some equipment, some advice), a derelict autobody shop became a functional work area boasting a video production area, two video editing suites, a digital recording studio, a suite of musical keyboards, an Internet area, and various computers for desktop publishing and related crafts. In one area we offer not only Communications Technology but also an Art of Television course from the Drama department and a Music and Computers Course from the Music department. This year we have produced our first digitally mastered CD of totally student written and student produced work, and our first half-hour TV production, *Noise*, against professional competition, won the Ontario Cable Television Producers' award for best youth television production of 1996.

Toys don't make a program, of course; good teachers do, and we have been fortunate to have staff who transcend departmental boundaries to create some very special experiences for our students. For some years now, the Visual Art and English departments have collaborated on a journalism course which runs at each of Grades 9, 10, 11, and 12. Students get to produce the school newspaper, magazine, and yearbook. The program is Mac-based, which has been an uphill struggle in a school board committed exclusively to DOS and Windows. Nevertheless we have managed to maintain two labs, each now with 4 Internet sites, to support the program. For a time we created the Credit Valley Conservation organization's semi-annual newspaper *Waterways*, which was a real win-win example of a school partnership. The students got the chance to produce "real" work, while CVC got a professional product produced to the camera-ready stage at minimal cost. Unfortunately, CVC has had to abandon the alliance as their financial situation grew more bleak.

Last year the Peel Board began a new three-year infusion of computers into its schools, and Turner Fenton was privileged to be included in the first year. In planning where the equipment would go, the basic controversy was whether the new equipment should go to upgrade existing labs, or go to programs and departments which had not yet made significant use of computers. The decision was a compromise: upgrade existing labs so our best programs are on the most modern equipment but install one cross-curricular lab in the library to be available to any teacher to book for whatever period of time he or she needs. The widespread interest in this facility by staff across the school has been most gratifying. We have run scores of staff in-service sessions, some offered by school staff and some by students (!), and reaction has been uniformly positive.

With a large number of computers finally available to the student body, we have turned to the Internet. As school resumes this fall, we have 50 Internet sites around the campus for student use and we have our own Web site — http//www.turnerfenton.com. We have also established our own school bulletin board system with the usual features for students and, this year, with another purpose as well. Two sections of DIC 2A0 will be provided on-line. Students in these classes will be in a standard classroom environment half the time, but for the other half will pick up and return their assignments by dialling into the BBS from home. After hours, eight of the school phone lines switch over to the BBS, joining two 24-hour dedicated phone lines. Hopefully this will allow sufficient access for the 50 or so students involved in the two courses. While starting small, we are thinking big. This year two classes can be scheduled into the same room at the same time in alternate weeks. With this approach, we can see part of the solution to Peel's accommodation crisis.

One lab in the technological studies area of the school was also given the mandate to service the integrated Grade 9 math, science, and technology program. In 1995/96, Grade 9 students received two units in the manufacturing laboratory, working either on a design project or, in the case of three classes, on an ecology unit based on a new TVO package, *The Fragile Earth*. In this latter example, students reviewed videotapes of four endangered ecosystems and then produced a reflective multimedia presentation on computer, combining video, still photos, and music as well as written and voice-over text. The students seemed instantly adept with the software and produced slick work; however, one would never lose sight of the fact that these students were only in Grade 9. Even with all the bells and whistles, a presentation still needs a thesis, cogent arguments, and conclusion. Next time we will include the English Department in the collaboration!

> If the world has changed that much in my adult lifetime, how can schools possibly not change? How can a Grade 10 geography class fill in maps with coloured pencils rather than manipulate GIS data bases?

Students arrive at TFC with widely varying computer skill levels; one of our feeder schools is a technology pilot school for our board, while others have placed their emphasis elsewhere. To bring all students up to a sufficient minimum skill level, a task is parcelled out to two groups. The first is the Grade 9 English/keyboarding course. Formerly, like most schools, these were separate subjects and most students took keyboarding as their mandatory Grade 9 business/technology credit. Clearly, *all*, not most, students need to have keying skills, so the Business and English departments now share a common course, which has proved most successful in meeting the needs of each supporting department. In particular, students who have already mastered the basic computer skills can be fully occupied with the English dimension, and those to whom the on/off switch is a new discovery have the opportunity to get the extra assistance needed to master these machines.

The other part of the solution lies with the resource centre, which has taken on an ambitious program to acquaint Grade 9 students with the basic research skills, up to and including Internet, that they will need to get through high school. This unit is addressed through the self and society course and runs periodically through the course.

Once students are adept with library computer skills, the next step would be to make the library resources available to them online from home. We may be close to getting our students such access through our school BBS, but policy issues at the board level remain to be worked out. Similarly we would like to get our students some form of cut-rate home access to the Internet but we have not yet found the appropriate mechanism.

Technology is something more than computers, of course, but the monetary demands of keeping equipment contemporary have largely defeated us, as they have almost every other school. We invested the second round of Ministry technological renewal moneys into a manufacturing laboratory. There is a CAM station and vacuum-forming equipment, but the overwhelming impression you receive upon entering the room is that of a machine shop circa 1950. Students are not flocking to sign up for manufacturing courses, and I doubt if anyone is surprised.

To get kids excited about technology, we have turned to the competitions available to us, namely the Canada First annual robotics competition and the skills competitions offered by Skills Canada. We have settled into a routine in which, each February, about 100 of our students, from all grades and with experiences from basic to enhanced, work night after night until midnight to get the TFC robot ready for competition. Our corporate partner, Xerox, has been wonderful with finding professionals in their firm who give unstintingly of their time and show the students exactly what engineering and the technical support skills are all about. I commend the Canada First experience to everyone. Similarly, the wide breadth of experience offered by Skills Canada is an opportunity for kids that cannot be duplicated anywhere else, and I am at a loss to understand some schools' reticence to be part of the program.

Another dimension of TFC is our dedication to build a commitment to community service. One way our students can serve is by attending to the environment, an issue with which it is easy to capture young people's in-born idealism. The TFC enviroplan has become an exciting partnership among ourselves, the city of Brampton, the Ministry of Natural Resources, and Credit Valley Conservation. In the last couple of years, students have been involved with bank stabilization of Credit River tributaries and cleaning out a century's garbage in a mile-long stretch of the Etobicoke Creek adjacent to our campus. Students have been out finding the co-ordinates of the trees in the Etobicoke valley for the city's official GIS maps of the area. Hundreds of trees have been planted on our campus and many more are growing in our nursery, destined to be transplanted into the river valley. Our Grade 12 enhanced geography class undertook a pond study for CVC based on aerial photos of the Credit watershed that the group provided; it was research the CVC needed but could not afford to buy professionally, and it was an opportunity for our students to undertake "real world" research. It was another example of the win-win situation that a successful school partnership can provide. Finally, all the above activities has led to an aquaculture course at TFC, the only one in Ontario, to the best of my knowledge.

TFC is large school and a very busy place. In the end, however, we can only be counted a success if we provide our graduates with the skills they will need to be successful in the next millennium, and these will in some part be very different from the skills which served my generation. Schools must embrace the vast changes happening beyond their walls or they do a major disservice to their student body. We are trying to do just that. Although it is clearly a never-ending journey, we have discovered a wonderful secret: it is a lot of fun pursuing the quest.

The Computer Team

Integrating Computer Technology into Instruction

The Evolving Experience of One Ontario School

By J. MACINNES

Principal

And S. KISSOON-SINGH

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Fletcher's Creek Senior Public School
Peel Board of Education

The importance of integrating computer technology into the classroom has been prominent in the discourse of educators for over a decade (Hancock & Betts, 1994). This prominence is underscored in the recent Royal Commission Report which emphasizes computer literacy as one of the "new basics." This article examines the impact of this emphasis by focussing on how one school's initiative on integrating computer technology in the classroom has evolved over the past four years.

Three important themes characterize how the integration of computer technology into instruction has evolved at Fletcher's Creek Senior Public School:

1. a constructivist approach to students' learning with computers — emphasizing the computer as a tool in students' knowledge construction
2. an outcomes-based approach to planning computer-based learning activities — allowing meaningful reconciling of students' needs, teachers' objectives, and societal goals
3. a team-approach to the process of utilizing computers in the classroom — emphasizing that a significant proportion of the staff's and students' knowledge is constructed through collaboration and social discourse

Computers and the Constructivist Approach to Student Learning

The instructional philosophy that guides our integration of computer technology into instruction derives from the cognitive science theory of "constructivism." A significant number of cognitive scientists now examine learning as a process of constructing one's cognition or thinking/understanding. These theorists suggest that learning occurs not by recording information but by interpreting it. According to this view, a student's knowledge derives from his or her personal interactions with the information available in learning contexts (Bereiter & Scardamalia, 1989; Glaser, 1991).

The traditional view of instruction as the direct transfer of knowledge does not fit this constructivist perspective. This latter perspective posits that effective learning depends on the intentions, elaborations, and representational constructions of the individual learner. At Fletcher's, the emphasis has been on instructional approaches that place the learner's constructive mental activity at the centre of classroom interactions. This instructional philosophy has guided this school's efforts to integrate computer technology into the classroom.

This emphasis has not meant that the students have been left to discover everything for themselves. Rather, teachers have tried to utilize techniques and contexts for optimizing learners' knowledge construction processes. Instruction has been directed to provide skills and strategies that stimulate active knowledge-construction even among students who initially doubt their ability to do independent thinking. Using the computer, this instruction has provided the graduated and supported practice of cognitive skills in actual contexts within several subject areas.

Computers and an Outcomes-based Approach to Instruction

The Common Curriculum provides guidance on reconciling the goals of society, the needs of individual students, and the professional objectives of educators. This document specifies more than 90 percent of the "basics" that teachers should teach. It posits how the educational experiences in the classroom could be targeted to achieve well-defined and measurable outcomes in students' learning.

At Fletcher's, the approach suggested by the *Common Curriculum* is viewed as a validation of the school's ongoing initiative to provide educationally relevant instructional programs. The outcomes set out in this document closely parallel those articulated by the school's staff since its inception. In its efforts to integrate computer technology into instruction, the staff guides students to use this technology:

1. to gather, sort, and make sense of information
2. to communicate effectively
3. to develop and utilize the skills of learning
4. to collaborate with others
5. to solve problems and to think creatively
6. to apply aesthetic judgment in completing tasks
7. to make well reasoned and appropriate choices
8. to acquire an understanding of their immediate world and the global community

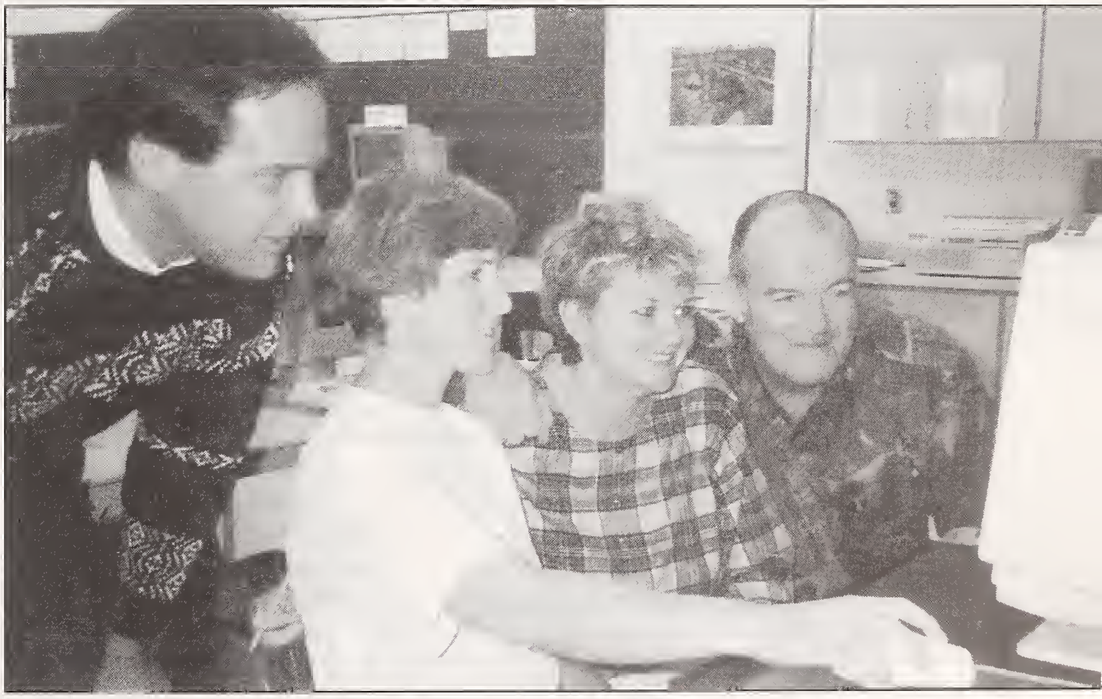
A Team Approach to Integrating Computer Technology Into Instruction

At its inception, the school's administration and staff shared a vision which would establish a role for educational technology in instruction and learning. The recruitment of staff and the meeting of minds which followed began cautiously, with everyone feeling excited about the opportunities this technology could provide. These feelings have gradually been replaced by a spirit of co-operation on both technical and instructional issues as staff aspire to provide the best computing opportunities for all students. One of the most crucial steps in the successful integration of computers into the classroom is the securing of the administration's support, the establishing of a school vision about the use of educational technology, and a sharing of this vision with all staff.

To guide the initial steps in our integration process, a committee was formed. Its membership consisted of teachers, the school principal, representatives from ICONIX Program Services, and the school board's Information Technology Services. This committee (or steering group) was given the task of developing a computer plan and making decisions for integrating this technology into instruction. Over the years, this group has continued to deal with technical problems; equipment allocation, use, and repair; scheduling of instructional use of software; and other implementation issues. The formation of a steering group or coping structure to build team spirit and collaboration is necessary for the successful implementation of change elements (such as computer technology) at the school level (Fullan & Miles, 1992).

In collaboration with all school staff, the steering group mandated several notable innovations for the first two years of the school's computer integration process:

1. hardware: to establish a networked configuration of computers with workstations distributed throughout the school and with clusters in a computer laboratory and the school's resource centre
2. software: to provide instructional support in utility programs and OESS software and to establish links between all available computer software and regular classroom activities
3. staff training: to establish a "pool" of



Teachers helping teachers ...

in-school expertise through a systematic training of all teachers and to provide communications software for facilitating dialogue between all staff on the practice of computer skills

4. student learning: to provide computer training and mentoring at all grade levels for all students on a regular basis within the regular instructional periods

It became obvious that an essential step in the process of integrating computers into the classrooms involves preparing all users for this intellectual journey by putting all resources (both machine-oriented and human) to work.

The productivity package platform selected for use included the Microsoft Works library of programs. The software included a wordprocessor, a spreadsheet, and a database. Several application programs were also selected to support specific curriculum needs — for example, social studies (Refugees in the Wilderness), mathematics (Mathtrek), science (Candle Flame) and so on. Later, users were also introduced to software for desktop publishing, authoring, scanning, drawing, and designing. It was essential for the users of the computer systems to identify and appreciate how the technology could be used to support both routine classroom tasks and creativity in the processes of teaching and learning.

Several teachers being taught by one of our enabled students.

A core group of teachers was organized to provide in-school professional development sessions to staff on the uses of computer technology. These sessions were designed to build on the initial enthusiasm surrounding the instructional possibilities of this technology. In these sessions, teachers collaboratively explored the content and skills relevant in the use of communications software (intranet and internet), productivity software (wordprocessing, spreadsheet, etc.), educational search software, curriculum-oriented software (OESS programs, CD-ROM's) and higher-level instructional software (publishing software and authoring software). Integration of computer technology in the classrooms requires all staff to commit to a learning process and to be prepared to learn. The success of this process has depended on all technology users at Fletcher's being able to function as a interdependent community of learners.

At Fletcher's, computer-based learning began at the classroom level. A "computer-literate" teacher was added to each grade level as a computer mentor to provide students with training in computing skills as part of the regular program. This person guides the process of identifying skills and application programs which could be used to meet the unique curriculum needs of the teachers and students at each grade level. Within this arrangement, care has been taken so as not to remove the initiative for software selection and integration from the core teachers. This strategy has resulted in the creation and availability of a resident pool of "student computer-experts" at each grade level. Integrating computer technology in the classroom appears to be successful when the process requires both students and teachers to learn together and to learn from each other at the classroom level.

We have also made efforts to use computer technology to support several school-wide activities. These activities include teacher-initiated tasks such as assessment and evaluation, communication with parents through class newsletters, and so on. They also include such teacher-student-driven activities as the creation of the school monthly newsletter, the production of the school's video yearbook, music productions, and technology and design projects. Staff share the belief that the integration of computer technology into the classroom is helped tremendously by its persistent use to support out-of-class applications.

With computer expertise being available and used at each grade level, the next step was the expansion of applications to encourage use of technology at the cutting edge. Staff and students are now being enthusiastically encouraged to pursue uses of computers in multimedia projects, using CD-ROM technologies, sound, and graphics to improve learning, instruction, and communications. This has helped to ensure that in-school computer-based activities reflect consistency with the direction and emphasis of emerging innovations of this technology. It is essential that the integration initiatives undertaken at school level be kept up to date with the changes in the capabilities of hardware/software in the marketplace. It is not necessary to continually upgrade the school's hardware components, but it is important to position users to take advantage of newer technologies as these become more accessible and affordable.

We have tried to encourage on-site research into the applications of computer technology in the curriculum. One example of such research is a recently concluded project which was designed to investigate the effects of using co-operative groupings with computer-based instruction in the teaching of science at the Grade 7 level. This project involved collaboration between the core teachers and science teachers. In this project, utility programs were used as a software platform for instructional activities on essential process skills in science. These activities were designed, developed, implemented, and assessed by staff with all grade-level students. The findings of this project support the use of heterogeneous ability-groups in computer-based instruction.

> **A** "computer-literate" teacher was added to each grade level as a computer mentor...

A similar project pursued jointly with TVO has recently been completed exploring the use of interactive multimedia software in the study of topics in social science and science. Participants in this project developed a model for introducing multimedia-based technology into classrooms. To date, this project has promoted co-operation between core teachers, subject teachers, students across Grades 6, 7, and 8 personnel at the school board's Program Services, and TVO. The initial dialogue, planning sessions, training, and computer-based activities have been informative and inspiring.

Conclusions

A commonly shared belief at our school is that instruction should start with students, with the skill-sets they already have. The daily instructional activities at the school should then focus on enhancing these skills so that all students are able to participate to the best of their ability in an ever-changing global context. These activities are easily improved with the use of a variety of forms of educational technologies. At Fletcher's, we have focussed on computers to enhance student learning but we use other kinds of technology as well — video, camera, slide projectors, etc. — to build skills and strategies.

The experiences of the past four years of technology integration at Fletcher's underscore the point that the process of integrating computer systems into instruction requires much more than financial investments. It requires a commitment of, and to, the members of the institution. This commitment is critical in dealing with the many problems and challenges that continuously arise. With commitment to people first, the problems always seem to be opportunities for learning, not situations for directing blame. With this attitude of collaborative adventure we hope to continue to move on as a community of learners to explore the benefits of the emerging applications — the Internet and virtual reality.

This article is submitted on behalf of the Computer Committee at Fletcher's Creek Senior Public School, Brampton.

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Using Technology to Support Student Learning

"Just-In-Time" Curriculum Management and Delivery

By ROBERT HOLOWACK
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If you were to visit the technology area at St. David Catholic Secondary School, you would see approximately 120 students enter four technology labs, sign in on the attendance lists, and begin to work.

This student-driven approach to learning allows the students a great deal of freedom to move about the technology area, determine their own course of action, and solve their own problems.

The students would be working on challenges related to their course material, everything from creating video advertisements to diagnosing automotive problems. Students work in groups or individually, depending on the challenge and the situation. Most of the instruction is individualized and student centred, with the teacher acting as a facilitator. The computer plays a major part in curriculum delivery. Students access learning materials in the form of instructional videos and computer-generated activity guides, information books, resource materials, and computer programs. Students sign up for the instructor's assistance when required. Because the program material is stored in a large database, the student maintains an independent program and is not limited to a preprogrammed approach to learning. Whole classes meet with the teacher about once a week to share experiences and discuss field trips or other whole-class issues.

This student-driven approach to learning allows the students a great deal of freedom to move about the technology area, determine their own course of action, and solve their own problems. A learning environment which provides this level of freedom requires a highly structured support system. This is the purpose of the "Just-In-Time" Curriculum System — a comprehensive computer supported approach to student-centred learning.

A Closer Look

The Just-In-Time approach has been used by technology students from Grade 7 to 12 for a number of years. It is currently being implemented in the History and Math departments. In order to take a closer look at a cross-curricular application, we will follow Melaney, a Grade 9 student who is working on a challenge related to creating a newspaper. (The background information for this example has been taken from an actual challenge developed by John Fioravanti, History Department Head at St. David CSS.)

Melaney is a member of a four-person team which has been assigned the challenge of creating and presenting a newspaper depicting the Canadian post-war period. The newspaper must contain five news stories, two editorial essays, a political cartoon, a sports section (complete with statistics), a lifestyle section, a personal biography of an important person, and two advertisements.

The first step in the process requires Melaney's team to meet and complete a plan of action for the identified challenge (see Fig. 1-a). In the plan of action, Melaney's group decides which activities are required to solve the challenge and who will complete each activity. Students are encouraged to research information in order to complete the plan of action. Melaney's group uses the history textbook to get an overview of the post-war period; they also look at current newspaper layouts. Once the students have established their plan of action, they will discuss it with the instructor, who may suggest possible modifications.

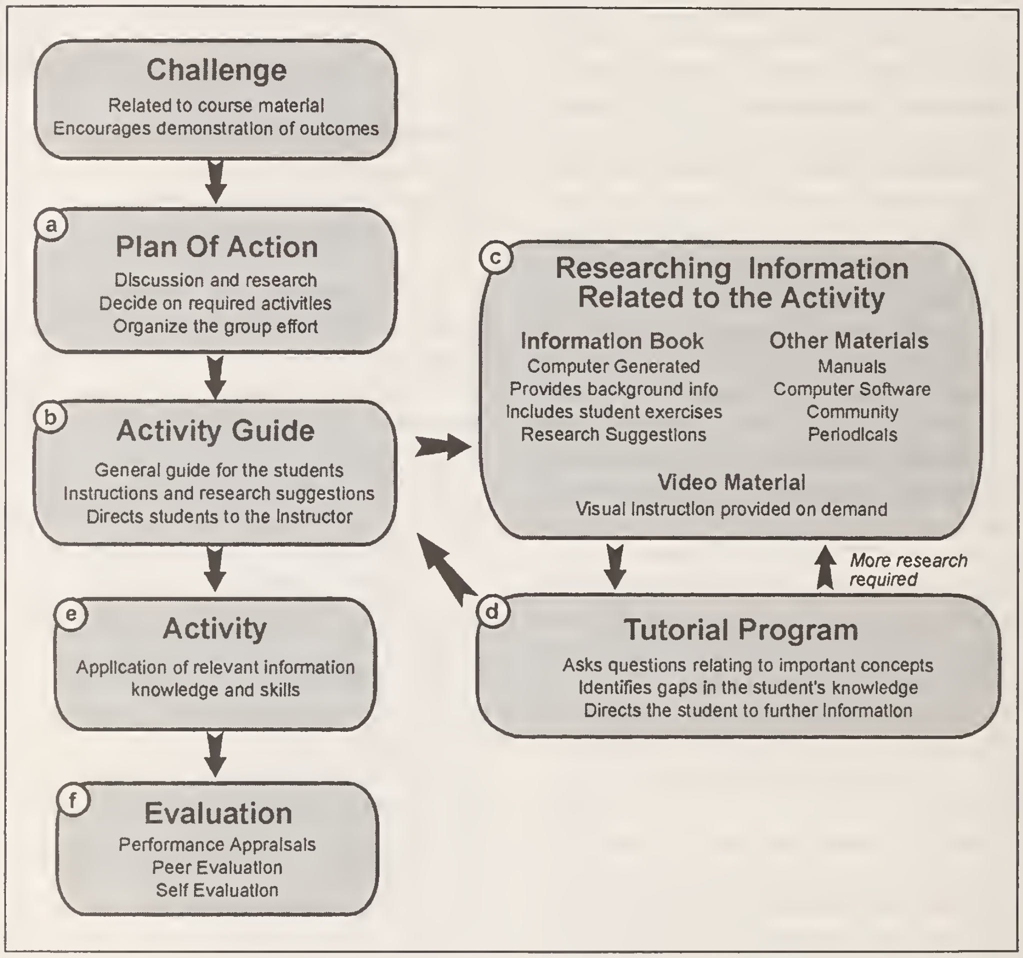
Some of the activities included in the group's plan of action are: doing further research in the library, creating a political cartoon, writing an editorial essay, doing the newspaper layout, and production of the newspaper. After discussing possible approaches, the team decides the most efficient method of completing the task is to work in pairs. Each pair is responsible for creating specific portions of the newspaper.

Melaney and her partner are responsible for creating a political cartoon and writing an editorial essay. Since Melaney knows nothing about political cartoons, she needs some support. At this point she accesses the Just-In-Time curriculum database and completes a search for activities related to cartoons. She finds that there is an activity called "Political Cartoon Creation" (see Fig. 1-b). She selects this activity and views a short summary of the activity's contents. She then chooses to view the whole activity on the computer screen. Melaney hits the appropriate key, and the activity guide is printed on a laser printer. After the printing is complete, she will insert the pages alphabetically into her personal "activity binder." The activity binder becomes a portfolio of her performance in the course, containing an overview of all the activities completed.

The Activity Guide ensures that Melaney is directed to related theoretical information. In this case she finds a line referring her to an Information Book concerning political cartoons. This Information Book is also viewed on the computer and printed using the laser printer (see Fig. 1-c).

Together, Melaney and her partner use their Information Books to complete exercises relating to the theoretical aspects of creating and analysing political cartoons. The Activity Guide then directs the students to the instructor who will inspect their work for completeness and discuss any areas of weakness. When the work has been satisfactorily completed, it will be initialled by the instructor. Depending on the nature of the activity, Melaney might have been directed to other resources, such as computerized tutorials (see Fig. 1-d), videos, library reference materials, technical manuals, periodicals, or persons in business and industry (see Fig. 1-c).

Figure 1 (a through d) **Overview of the "Just-in-Time" Strategy**


Challenge
Related to course material
Encourages demonstration of outcomes
a
Plan Of Action
Discussion and research
Decide on required activities
Organize the group effort
b
Activity Guide
General guide for the students
Instructions and research suggestions
Directs students to the instructor
e
Activity
Application of relevant information knowledge and skills
f
Evaluation
Performance Appraisals
Peer Evaluation
Self Evaluation
c
Researching Information Related to the Activity
Information Book
Computer Generated
Provides background info
Includes student exercises
Research Suggestions
Other Materials
Manuals
Computer Software
Community
Periodicals
Video Material
Visual Instruction provided on demand
More research required
d
Tutorial Program
Asks questions relating to important concepts
Identifies gaps in the student's knowledge
Directs the student to further information

The Activity Guide provides Melaney with a detailed list of steps to help her complete the task. It also indicates points during the process where she and her partner must ask the instructor to check their work. Melaney's group is encouraged to suggest improvements to the course materials. The instructor notes the suggestions and modifies the material so the next student using the material benefits from the modifications.

Melaney has the opportunity to utilize the Just-In-Time curriculum materials many times during her work on this challenge. She uses the "Researching in the Library" Activity Guide created in conjunction with the school librarian. She accesses an Activity Guide called "Creating an Editorial Essay." She may also access an Activity Guide created by the communications technology teacher on using publishing software. She even uses the "Creating an Oral Presentation" activity to help her create the presentation of her newspaper. The Just-In-Time curriculum materials allow the students in Melaney's class to work independently in many different areas, accessing the expertise of many different people.

The instructor acts as a facilitator checking with each student on a periodic basis and writing comments in each student's activity binder. These comments are used by the instructor when he or she is preparing student performance appraisals. The performance appraisals relate to the desired student learning outcomes — skills, concepts, and attitudes. The instructor uses a computerized format to input comments for each student describing his or her progress related to each learning outcome. The appraisals provide Melaney and her team with regular feedback on their progress.

The students complete self-evaluation forms on their personal progress as well as peer evaluation forms relating to their group's progress. A student's overall progress evaluation is made up of a combination of all these methods (see Fig. 1–f).

Cross curricular integration occurs naturally as students search for relevant curriculum materials. The efficient manner in which the Just-In-Time system uses resources allows a class of 30 students to be supported by three or four computers.

Support for Teachers

Once the Just-In-Time curriculum material is created, any student from any subject can access it. There are currently about 450 Just-In-Time curriculum packages in the database.

A number of teachers from various school boards have indicated an interest in using the Just-In-Time approach. In response, I created a 16-hour in-service program during which teachers are provided with an overview of the approach and instructions on how to create material using the Just-In-Time authoring tools. John Fioravanti attended one of the earliest in-service sessions but did not become involved with the Just-In-Time approach until years later. "I just could not make the leap from the traditional approach," he explained, "but it kept nagging at me. I have been looking for an approach like this my whole teaching career." John said he views the Just-In-Time approach as "outcomes-based plus" and that his increased understanding of outcomes-based education made his transition to the Just-In-Time approach easier.

The Just-In-Time system has the potential to support a school of 2000 or more students as they use the curriculum database to solve challenges. The curriculum files can be transferred electronically from school to school and board to board. The common format of the curriculum materials and authoring tools allows the teacher receiving the material to easily make modifications to suit his or her students' needs.

The Just-In-Time curriculum system is an economical way of utilizing educational resources to support students as they acquire the skills, knowledge, and values required to meet the demands of today's society.

For more information about Just-in-Time Curriculum, call the author at (519) 886-6948.

From the Arctic Project to the Next Generation

Curriculum Development and Distribution of Resources

By THOMAS STIFF

Secondary School Computer Consultant
Simcoe County Board of Education

In the beginning there was chaos, then The Ministry of Education and Training said "Let there be curriculum" ... and there was more chaos. Tempted by the forbidden fruit of knowledge, humankind was forced to invent boards of education to deal with the chaos. Boards, in turn, formed committees, and committees interpreted curriculum.

When times were good, curriculum was abundant. When times were not so good, curriculum and, more specifically, resources for teachers and students were scarce. To make matters worse, curriculum was often changed, and a new cycle of chaos ensued. As humankind struggled, the tools of technology brought forth the computer age, and the end of chaos was in sight. All that remained was to tame the Demon of Technology.

> During the four months of the polar expedition, 44,000 students in Simcoe County followed the daily progress of the explorers and achieved significant progress towards satisfying a wide range of curriculum outcomes.

For The Simcoe County Board of Education, this taming began in the form of a rather small and unremarkable project using the Internet as a resource. The project would allow students and their teachers to follow the explorations of an international group of intrepid scientists trekking through the harsh winter environment from Siberia to the North Pole and into Canada.

The initial plan was merely to follow the day-to-day progress of these explorers, but, as our involvement with the project increased, it became clear that a large number of curriculum-specific outcomes could be linked to the activities of this polar expedition. The simplest way to build these links was to create Internet Web pages with hypertext links between the outcomes, the activities of the expedition, and classroom-specific activities. In this way, teachers would have an inventory of Common Curriculum-based, classroom-ready activities. The Simcoe County Board of Education's International Arctic Project's activities were made available not only to Board staff but worldwide through the magic of the Internet.

To enhance access to board's International Arctic Project Website, the Simcoe County Board created a toll-free, cost-free, full-service, Internet dial-up network, using WorldGroups from Galacticomm, to enable teachers to prepare related classroom activities, based on the outcomes from *The Common Curriculum*, from the comfort of their own homes. These activities were shared among all staff, at all levels, in both the elementary and the secondary panel. During the four months of the polar expedition, 44,000 students in Simcoe County followed the daily progress of the explorers and achieved significant progress towards satisfying a wide range of curriculum outcomes in their related classroom activities.

Based on the success of the International Arctic Project, it became clear that a wide range of classroom activities and Common Curriculum outcomes could be provided for teachers in a dynamically managed Internet database. The search for such a database led to the discovery of The Common Curriculum DataEngine. The DataEngine allows a board not only to provide Common Curriculum-based outcomes to every teacher in its employ but also to provide each and every teacher with specific activities designed to achieve these outcomes. Furthermore, the DataEngine allows for the dynamic management of all links between board-developed lessonware and *The Common Curriculum.* Another unique feature of the DataEngine is that it is "platform independent"; that is, it works equally well on any computer which can browse the World Wide Web, whether it's a Mac, a PC, or a Unix machine. A board's lessonware can be accessed by teachers working from either home or school, and all modifications to the lessonware are applied instantly and globally.

The Simcoe County Board has developed a base set of lessonware units, called *The SCBEPack* covering all areas, and levels, of *The Common Curriculum.* Each piece of lessonware provides teachers with activities, multiple-intelligence strategies, assessment tools, and links to the curriculum. In addition, *The SCBEPack* contains over 600 curriculum-specific links to resources on Internet, such as the Royal Ontario Museum and the McMichael Gallery in Kleinburg. Schoolnet resources also figure strongly in the lessonware packages.

One of the biggest transformations has been the way in which teachers regard curriculum and curriculum development. The DataEngine provides a utility which allows teachers to submit either upgrades, additional lessonware, suggestions for improvement, corrections or revisions in lessonware, and new Internet sites for related resources, directly to their board for consideration, to be added to the lessonware database. Instead of lessonware being a rather static resource, the database of curriculum-specific lessonware is instantly transformed into a continually evolving, improving, and expanding resource.

The feeling among teachers is one of excitement and enthusiasm. The DataEngine's utility and functionality is designed not only to improve a board's database of lessonware but also to foster a climate of teacher involvement which creates genuinely motivated teachers in the classroom. During the summer of 1996, over 600 teachers and support staff from our board volunteered to take part in the DataEngine in-servicing during their holidays. Their reaction was extremely positive. According to teachers who are currently active DataEngine users, there has been an overwhelming request for in-servicing from other staff. Luckily, the simplicity of using the DataEngine has meant that most teachers in-serviced during the summer have become instant experts, and they have enthusiastically passed their new-found skills and knowledge on to their colleagues.

At the present time, the original 100 units of the *SCBEPack* are being fine-tuned and are nearly ready for release. Numerous boards in the province are currently using an early prototype and will be receiving the final version of the product shortly.

In the meantime, the Simcoe County Board of Education is undertaking the development of the next 100 lessonware units, dubbed *SCBEPack II (The Next Generation)*, which will complement the original set of units. Like the original units, the next set will contain outcomes and multiple-intelligence strategies, but they will also include performance indicators and a range of unique assessment tools. This project is targeted for completion in the spring of 1997.

Websites Of Interest

Information about the DataEngine can be found at http://www.gta.ca

Information about the *SCBEPack* can be found at http://www.scbe.on.ca/prog/scbepack.html

Information about the 1995 International Arctic Project can be found at http://www.scbe.on.ca/1995.html (look under 1995 Projects)

The Learning Consortium

The Learning Consortium is a school/university partnership formed in 1988 between four school boards — Durham, Halton, North York, and Scarborough — and OISE/UT. Altogether there are 500 schools and 250,000 students connected to the Consortium.

The aim of the Learning Consortium is to improve the quality of education for students in schools and universities by focusing on teacher development, school development, and restructuring to support improvement on a continuous basis. The Consortium has three core objectives:

- to plan and initiate new programs in teacher development and school improvement
- to generate knowledge through documenting and researching these initiatives
- to disseminate new learning about teacher development and school improvement

The Learning Consortium is committed to launching specific initiatives to realize these aims. These began in 1988 with an emphasis on cooperative learning, a theme which provided a concrete point of departure. By year three, summer and winter institutes on cooperative learning and follow-up support were well in place, and dissemination conferences and inservice were carried out on such collaborative approaches as mentoring, induction, peer coaching and school improvement. The Consortium has consequently built on these early initiatives by offering a variety of professional development sessions on conflict management, anti-racist training, and assessment and evaluation of student performance.

The Consortium has tried to link these activities by paying attention to consistent themes teaching as career-long learning; fostering collaborative cultures; and focusing instruction while at the same time honoring the unique cultures of each of its partners.

For more information about the Learning Consortium, please call …

(416) 923-6641, ext. 2078

Broad-Based Technology

Preparing Students for Employment

By RON ST. LOUIS

Head Consultant, Technological Studies
Windsor Roman Catholic Separate School Board

Recently education in Ontario has come under scrutiny to determine what changes must be implemented to better prepare our youth for successful entry into the workforce. Statistics show that students graduating today will change career paths five to eight times and the prospect of being employed in one job for an entire working life is rapidly diminishing. If this is true, then our educational system must change the way we prepare our young people to ensure they hold the skills required for the global competitiveness they will face in the job market. This new era of lifelong learning is upon us now!

Business and industry in our local community of Windsor have sent a clear message as to what knowledge, skills, and values are necessary for an individual to gain successful employment in any career. Not surprisingly, the message we received is identical to the one put forth by the Conference Board of Canada. Certain generic "transferable skills" have been identified as being crucial for employment in any area.

The Windsor Roman Catholic Separate School Board took this message from industry six years ago, in conjunction with the Ministry of Education and Training's new direction and mandates, and revamped the technical programs in our system. Our programs were changed from a content-driven approach to a process-driven one. The student is placed at the centre of our focus, and this student-centred model revolves around "how to learn" rather than "what to learn." This new outcomes-based curriculum ensures students will have the opportunity to develop competencies in the key generic areas. Skills such as problem solving, information accessing, research skills, technical literacy and report writing, communication skills, teamwork skills, and so on are the *core* content now rather than subject-specific skills that may be outdated by graduation. It must be pointed out that subject-specific skills will still be learned but in a different manner than in the past. Students learn by doing and finding solutions on their own, with the teacher giving only direction. The students assume a large portion of the responsibility for learning. This is a complete reversal of program direction in the past, when generic skills were considered "soft skills" and not much emphasis was placed on them. All or most of the information was provided to the student by the teacher, and programs were teacher centred.

Community Involvement

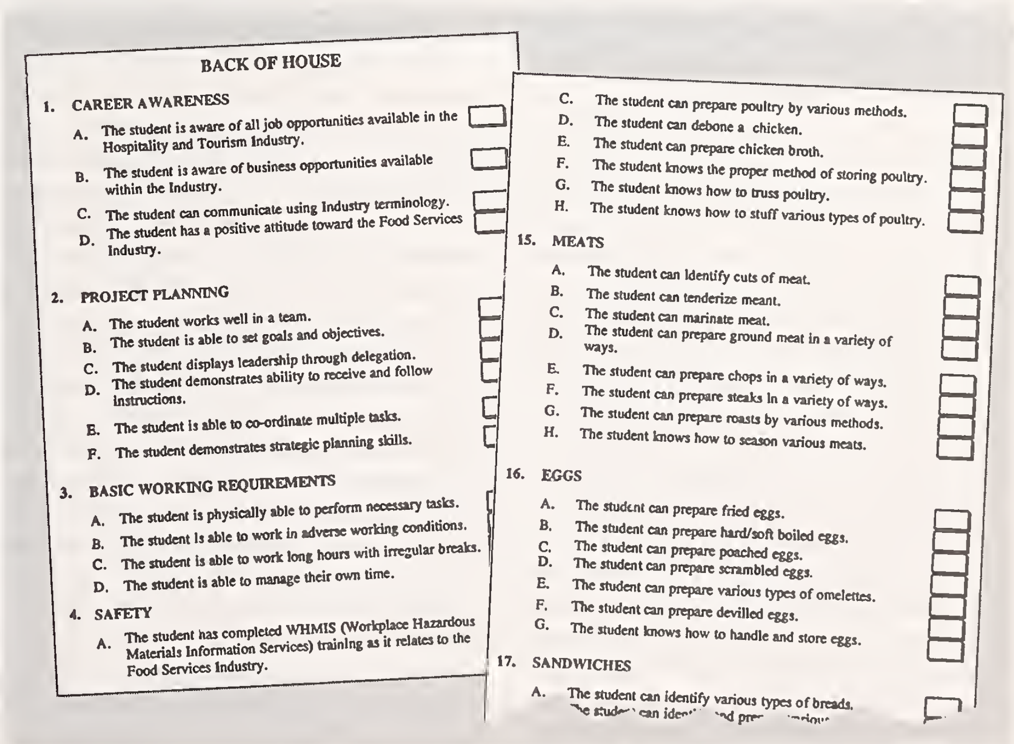
Once the decision to change our technical programs was approved by the Board, our community became very involved in the school system. Laying out and designing facilities, assisting in curriculum development, providing physical and human resources, assisting in delivery of curriculum, assisting in equipment updating, evaluating effectiveness of programs, and in-servicing teachers are all tasks that business and industry undertook and continue to undertake on an ongoing basis.

Student profiles were jointly developed to identify outcomes for the program that were measurable and trackable. The profiles are competency based with very clear descriptions for each performance level. They also generate the outcomes for the student activity sheets that students use to log their technical reports on and are evaluated to provide a numerical mark. Student profiles are used for more than in-school tracking. When students participate in the "Bridges" work placement program, the industry uses the profile to track the students and document the skills they are developing. The school utilizes these profiles as the basis for credit granting for Bridges and other work placements. Upon graduation, students are able to present these profiles as part of their résumés when applying for a job.

New Program Direction

Keeping in mind the skills identified by Conference Board of Canada and our local industry partners, the new broad-based technology programs require students to work in groups, as teamwork

Some Student Profiles



BACK OF HOUSE

1. CAREER AWARENESS
   - A. The student is aware of all job opportunities available in the Hospitality and Tourism Industry. ☐
   - B. The student is aware of business opportunities available within the Industry. ☐
   - C. The student can communicate using Industry terminology. ☐
   - D. The student has a positive attitude toward the Food Services Industry. ☐

2. PROJECT PLANNING
   - A. The student works well in a team. ☐
   - B. The student is able to set goals and objectives. ☐
   - C. The student displays leadership through delegation. ☐
   - D. The student demonstrates ability to receive and follow instructions. ☐
   - E. The student is able to co-ordinate multiple tasks. ☐
   - F. The student demonstrates strategic planning skills. ☐

3. BASIC WORKING REQUIREMENTS
   - A. The student is physically able to perform necessary tasks.
   - B. The student is able to work in adverse working conditions.
   - C. The student is able to work long hours with irregular breaks.
   - D. The student is able to manage their own time.

4. SAFETY
   - A. The student has completed WHMIS (Workplace Hazardous Materials Information Services) training as it relates to the Food Services Industry.

- C. The student can prepare poultry by various methods. ☐
- D. The student can debone a chicken. ☐
- E. The student can prepare chicken broth. ☐
- F. The student knows the proper method of storing poultry. ☐
- G. The student knows how to truss poultry. ☐
- H. The student knows how to stuff various types of poultry. ☐

15. MEATS
    - A. The student can identify cuts of meat. ☐
    - B. The student can tenderize meant. ☐
    - C. The student can marinate meat. ☐
    - D. The student can prepare ground meat in a variety of ways. ☐
    - E. The student can prepare chops in a variety of ways. ☐
    - F. The student can prepare steaks in a variety of ways. ☐
    - G. The student can prepare roasts by various methods. ☐
    - H. The student knows how to season various meats. ☐

16. EGGS
    - A. The student can prepare fried eggs. ☐
    - B. The student can prepare hard/soft boiled eggs. ☐
    - C. The student can prepare poached eggs. ☐
    - D. The student can prepare scrambled eggs. ☐
    - E. The student can prepare various types of omelettes. ☐
    - F. The student can prepare devilled eggs. ☐
    - G. The student knows how to handle and store eggs. ☐

17. SANDWICHES
    - A. The student can identify various types of breads. ☐

skills are crucial. Three or more students develop their project from conceptual stages through to design, prototyping, costing, fabrication/delivery, marketing, and final presentation of product or service. Each student takes ownership of specific portions of the project. Students are required to research all aspects of the project, including safety, equipment operation, cost estimates, alternatives, ordering of materials, fabrication, packaging, and so on. Their research may include utilizing videos, CD-ROM's, fax machines, telephones, manuals, or personal interviews in the community to determine the needs for a particular project. As students are developing and researching their projects, they are required to write technical reports in the form of project sheets and activity sheets that document all of their research materials. They continually dialogue, make alterations, solve problems as a team, support each other, and bring the product or service to completion. Students quickly realize the interdependency and importance of one another's role in bringing the project to completion.

> All projects must include a marketing strategy that may be in the form of a newspaper advertisement, TV commercial, or a radio ad.

All projects must include a marketing strategy that may be in the form of a newspaper advertisement, TV commercial, or a radio ad. This requirement further enhances their technical literacy and report-writing skills; report writing has been identified as a crucial skill. Students also develop a safety video on a task they were required to be involved with while completing their project.

There is little doubt that this approach to program delivery puts a large part of the responsibility for learning on the shoulders of the student. The knowledge, skills, and values gained by these youth would not have been attained under the old teacher-centred system of program delivery. These skills are not taught from a textbook but are learned by doing.

Our local business and industry community acts as an extension of the classroom, providing a wealth of resources available for our students. This partnership is crucial as the community has a vested interest in our students, who are the future workforce. There is no better learning environment; this is the "real world" that our youth will deal with upon graduation.

Teacher Support

The shift that our broad-based technology focus has brought about in program structure, delivery, tracking methodologies, and so on is enormous. If this major shift in programming is to be successful, support must be provided for teachers both pedagogically and technically.

The teacher's role has changed from a deliverer of all information to a facilitator directing students to information sources. Teachers must be in-serviced and supported to make this change. It is much more difficult to direct and encourage students to search for a solution on their own than it is to provide them with the information. A whole new classroom-management structure must be developed for a student-centred program; individualized tracking, evaluation, tutoring, and monitoring systems must be organized and developed. Over the last five years, our Board has in-serviced teachers in the areas of program organization, management, evaluation, tracking, and resource development.

A true broad-based program houses a wide variety of equipment that will be new to teachers with trade-specific backgrounds. Most technical teachers are from a single trade area — for example, welding. These teachers must be given support to become comfortable on all the new equipment they will be faced with in their new environment. Hydraulics, pneumatics, robotics, CNC, computers, and so on are all foreign to these teachers. The high school principals in our Board have released all technical teachers for three to five consecutive exam days each semester over the last four years. During this time, our industry partners have in-serviced and trained our teaching staff in a wide variety of areas including computers, CNC operation, robotics, audio visual equipment, CAD, heavy manufacturing equipment, building maintenance equipment, hydraulics and pneumatics, and electronics. This training is up to date since it is being delivered by experts from the industry and is provided at no cost to the teachers. The support of the administration of our high schools has been excellent. As long as teachers are comfortable on the equipment and know the safe operation and set up, students will progress at their own rate and learning capability.

> Our industry partners have in-serviced and trained our teaching staff in a wide variety of areas including computers, CNC operation, robotics, audio visual equipment, CAD, heavy manufacturing equipment.

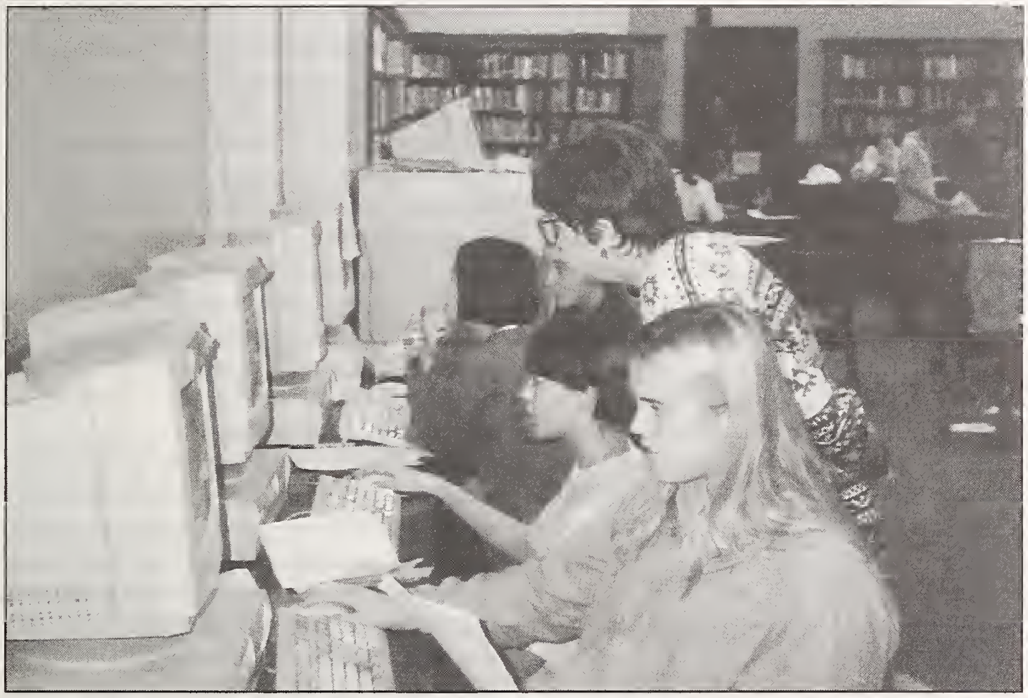
As classrooms currently exist, resources are not sufficient to make the change to a broad-based technology focus. Resources must be made available for students to access their data: TV's and VCR's, CD-ROM's, fax machines, telephones, Internet capabilities. This technology must be available if students are to be prepared for the real world of work they will face.

Conclusion

In conclusion, there is little doubt that this approach brought a new meaning to technical education. Enrolment has been increasing dramatically over the last five years with a very high percentage of advanced-level learners and females (groups that were absent in the past). The most valuable aspect of this change has been the important knowledge, skills, and values that students are gaining. These undoubtedly will be used throughout their working life and beyond. Technical teachers can take pride in knowing they not only prepared our youth for entry into the workforce but also provided these students with the skills necessary for lifelong learning. This new era of programming has been a major challenge to both students and staff in our system but well worth the effort. We must never forget we are dealing with the world's most valuable resource — our youth.

Teacher-Librarians and Technology

Implications for Programs in Ontario Schools



A busy library — with print and electronic activity — at UTS.

By ROSE DOTTEN
Teacher-Librarian
University of Toronto Schools

Historical Perspective

Partners in Action: The Library Resource Centre in the School Curriculum, the resource document released by the Ministry of Education in 1982, provided the foundation for a dynamic role for the teacher-librarian as a collaborative partner in the educational system in Ontario. The other significant cornerstone in this foundation is the concept of resource-based learning. Through a learning and teaching partnership, the student, the teacher, and the teacher-librarian can actively engage in the learning process using not only print resources, but audio-visual materials, reference works, periodicals, CD-ROM's, educational videos, computer networks, software applications, desktop publishing, telecommunications, and human resources.

These principles still underlie the current educational framework of integrating curriculum and providing a process for learning that is transferable across all content areas as well as being transferable from the academic environment to real-life situations. Many school boards supported the Partners in Action model by dedicating resources, both human and financial, to make the concept work within an educational model that sees learning extend beyond single-textbook learning and provides a broad range of resources and teaching and learning experiences. Furthermore, the model utilizes teacher-librarians' expertise in the integration of learning resources into the curriculum and in the selection, acquisition, and effective use of those resources, as well as teachers' specific curriculum knowledge and knowledge of students' individual learning styles and differences to develop a meaningful learning environment for all students.

Unfortunately, there were boards and individuals who did not recognize the value of a school library program or the collaborative role of the teacher-librarian. While many boards should be proud of their support of these enhanced learning opportunities for their students, in those cases where the program and role were not supported, the school library was only a warehouse of resources, duplication and classroom collections were the norm, and collaborative teaching partnerships seldom extended beyond the classroom. Those situations have added to the misunderstanding of the role of and undermined the need for an information literacy program; administrators and teachers in those areas have never had the opportunity to experience what a dynamic hub of learning the school library information centre can be.

In the 1990s, therefore, as we are bombarded with the realities of the information explosion and a very difficult, constrained economic climate, teacher-librarians are faced with a crisis. Some boards are actually eliminating school library programs and teacher-librarians at a time when they are needed more than ever to address the critical evaluative strategies inherent in information-literacy skills, which are the foremost components of library and classroom teaching and learning. If students are to be equipped for a world in which the ability to learn is more important than the knowledge of specific information, then they must become information literate; that is, they must be able to think critically and creatively, analyse and synthesize information, and solve problems efficiently. Within this context, emerging information technologies still need to be addressed as essential tools in developing information-literacy skills. A well-developed information-literacy skills continuum within the framework of a school library information centre program is accountable, provides equity of intellectual as well as physical access,

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and requires instruction. Computers after all, don't teach.

In 1995, the Ministry of Education formed a writing team and developed a document to supplement *PIA* and to address the issues of information technology, information literacy, and equity of access. The document *Information Literacy and Equitable Access: A Framework for Change* provides an opportunity for strong involvement for teacher-librarians. With their experience in information-skills instruction and collaborative planning, "teacher-librarians have a leadership role to play in providing professional development and in planning integrated information-literacy skills programs" (p. 6). But it is also true that teacher-librarians themselves need the support and technology skills to assist them in assuming this role.

One such program of in-service is being run in Simcoe County, where the teacher-librarians are released a half day per week to attend classes at the Board to enhance their technology skills and develop strategies for implementing the *Common Curriculum*. They have the support of their colleagues and their administration because the need to provide support for the teachers in the school is recognized.

A current reality is that many teachers are not computer literate. This is not a judgmental statement; it is simply the way it is. Teachers are concerned with the curriculum and the students they teach in their own classrooms. Class sizes are becoming larger and support for exceptional students is being withdrawn. Teachers are under pressure to rejig their methods to conform with the "learning outcomes" philosophy. They are immersed in their own rapidly changing field. Here then is an opportunity for the teacher-librarians to provide collegial and collaborative support and a school board that has the foresight to provide the means.

In my own environment, at the University of Toronto Schools, we are very cognizant of the need to provide an integrated information-technology program in our curriculum. Through the partnership of the teacher-librarian, the Library Information Centre program, the computer coordinator, the teachers, and indeed our parents and alumni, we are actively developing a model of implementation for just such a program.

In the broader context of Ontario education, however, we must face the reality that while not all teacher-librarians are embracing the new technologies and the learning opportunities, there are many that are and they are developing their own professional workshops and seminars in order to add the technological skills to their information skills to truly become the information specialists in the schools.

Evolutionary Process

When computer technology was first introduced into the Ontario curriculum, we struggled with ICON's, often used primarily for keyboarding and basic programming functions in lab situations. Once educational software became more readily available and equity of instruction and access became an issue, limited numbers of computers were placed in classrooms and in school libraries. Many teacher-librarians assumed the role of computer-site administrator within their schools and assisted teachers and students with the integration of these resources. Again, this was not consistent across the province.

> At the University of Toronto Schools, we are very cognizant of the need to provide an integrated information technology program in our curriculum.

When the next wave of technology came through — CD-ROM's, multimedia, local- and wide-area networking — much more sophisticated technical skills were required and a need for computer resource personnel emerged. This caused a great deal of confusion in roles. Teacher-librarians still felt their role was in information-skills instruction yet lacked the technical skills. The new computer resource personnel — teachers in most cases — often came to these positions because of their own strong personal interests, and, in many cases, personally developed expertise. These teachers performed a valuable role in making the resources accessible to teachers and students and providing relevant instruction in applications software.

Success of the technology program within a school is often represented as the acquisition of high-end hardware and the smooth technological functioning of this equipment. To reiterate a point, this notion really only addresses physical access and the importance of intellectual access is ignored. While many Boards are trying to implement the ideal — information-technology teams with expertise in technology, application, and information-literacy instruction — it is often too expensive to implement within the current fiscal climate. In some cases, school library programs have been eliminated because there is a perception that it is more important to keep the technical and clerical functions within these facilities operating. Yet in a recent quote, the Minister of Education and Training states that "there is no reason for school boards to cut services like libraries that affect classroom education."

Within these parameters, we must clarify roles and expectations of the individuals functioning in those roles and then address the current role of the teacher-librarian. A teacher-librarian in today's world must be prepared to accept the challenges: to be involved in curriculum development and leadership, information management, incorporation of information technology, information-literacy skills instruction in all curriculum areas, and to establish and implement collaborative program planning and teaching. To do this, they require support, and the most valid and credible support that can be realized is the integration of the ILEA document into all other Ministry Policy documents. If it is indeed seen as essential that our students are prepared to adapt to the changing world of work, to become thoughtful, knowledgeable, and productive members of the global community, and to be truly "information literate," a real commitment must be made.

It is not enough to supply the hardware and software that makes it possible to access information; receiving information is not learning; access is not learning; these are technical functions that should not replace a sound pedagogical framework. As teachers and teacher-librarians, we must help our students acquire the skills to determine the relevance and value of information; we must take responsibility for the teaching of integrated information literacy skills.

Section 3

OUTSIDE THE WALLS

How is technology being used for educational purposes in non-school settings?

* * *

How are these "learning organizations" changing our conceptions of education?

* * *

How is technology integral to their educational outreach?

* * *

How can partnerships enhance the effectiveness of schools?

* * *

Open for Learning

Electronic Information in the Public Library

By MICHAEL DEKOVEN

Access and Infromation Specialist,
Toronto Public Library

"Djugotny ... ?"

"Djugotny books on wolves?" (Or on the Olympics, or on the Shakespeare, or on any of a thousand other topics?) This is all too often the beginning of a scenario familiar to any librarian in a public library. A quick check of the library catalogue suggests four or five possibilities, but they are all out. A paragraph or a page might be located in some general works, and one or two items to photocopy from reference sources. An offer to get books from another branch is declined due to time pressures: "The assignment is due tomorrow!"

Technology to the rescue! With online or CD-ROM magazine databases, or access to Internet information sites, the librarian in your local public library can finally provide you with material on a huge range of subjects whenever you need it — even if you are the tenth or the sixtieth person to ask for information on that particular topic that day.

An Electronic Library Network

In 1995, the Toronto Public Library unveiled a new vision and a strategic agenda document on how to make that vision a reality. Our new vision is: "Information for a lifetime.... Helping the people of Toronto to discover, to learn, to grow, and to enjoy." The Library's strategic agenda recognizes that new technology is one of the key forces driving our society and that the public library has a role to play in ensuring that all the people of Toronto have access to electronic information, and expertise in using it. The Library's response has been to undertake the creation of the Toronto Electronic Library, an ambitious plan to roll out sophisticated electronic information services over the next few years to all our 33 branches across the city and to provide remote access to information resources via modem and Internet connections.

Many people don't think of libraries as technology leaders, but computerized library catalogues were one of the first non-military computer applications to move out of the labs and into the real world. Toronto Public Library's integrated, automated system provides both catalogue and circulation information to our users and staff in all 33 branches and by modem connections to home computers. Our users can not only search online for library material but also can reserve items they want to pick up and renew material they have already checked out.

The first step towards the Toronto Electronic Library was made in the fall of 1995 with the opening of our Lillian H. Smith branch with our first Community Learning and Information Centre (CLIC) or computer lab of 21 networked personal computers for access to our library catalogue, full-text magazine databases, the World Wide Web, and to multimedia CD-ROM resources. An additional ten networked PC's for the public are located over the four floors of the building to provide dedicated access to specific resources such as our library catalogue. Lillian H. Smith is connected to the computer room at our administrative service centre by a 128 Kbps ISDN connection.

In the spring of 1996, we replaced our library catalogue's analog connections to eight of our branches with ISDN connections. We now provide networked PC's to access the same magazine databases as at Lillian H. Smith at those branches and are in the process of rolling out access to the World Wide Web and to the Toronto Free Net. By the end of the year, we expect to install networked PC's and upgrade the communication link to an additional branch and to officially launch our own World Wide Web server.

Providing access to the same (or similar) databases and search software in the library and in the schools means we can rely on each other to help spread the training burden (and costs).

By early 1997 the Library will open two more CLIC's (thanks, in part, to a Microsoft Libraries Online grant), one at our Riverdale branch and one at our Parkdale branch. Like our first CLIC, these two computer centres will provide access to our catalogue, magazine databases, the World Wide Web, and to multimedia CD-ROM's via 15 networked PC's at each site.

The School/Public Library Connection

Toronto Public Library has always had a strong relationship with our local schools. Staff from our branches go out to schools in their area, and book talks and library instruction to classes visiting the library are an important part of our programming. We have also maintained links on an administrative level through various joint committees and at the school board level. These connections will not only continue in the computer era but will be strengthened with consortium purchases, electronic resources shared through open networks, and joint projects built around those resources.

Access to online or CD-ROM databases is a wonderful service for our users but it can be an expensive proposition. As well as the cost of the network connections and the computers and the cost of the databases, there is the less obvious cost of training people in using the search and retrieval software. Providing access to the same (or similar) databases and search software in the library and in the schools means we can rely on each other to help spread the training burden (and costs). Many database producers and aggregators are also willing to give significant price breaks for groups of institutions interested in their products. The Metro Toronto area school boards and the Metro area public libraries are actively exploring consortium purchases.

While this kind of resource sharing promises cost savings and efficiencies, I believe that new technologies will bring about a more profound change in the relationship of schools and libraries, and in the relationships of both of us to students and other users.

Conversion/Distribution/ Interaction

We could consider access to electronic full-text databases as the second wave in electronic information services in libraries. While the first wave saw the conversion of traditional library tools like indexes and card catalogues to digital formats, this wave no longer merely points to where information may be found but delivers the information itself. As well as the cost savings and efficiencies I mentioned earlier, this change in the way information is distributed will allow us to truly provide our users access to library resources anytime, anywhere (once technical and budgetary issues such as dial-in lines and modems and authenticating users to meet licensing restrictions can be dealt with).

It is the third wave now forming that will bring about a more fundamental change. If we can call the first two phases *conversion* and *distribution*, the third phase might be characterized as *interaction*. We are now beginning to see electronic resources such as multimedia CD-ROM's and the World Wide Web that are more than just a translation of existing forms (books, magazines, newspaper articles) into a digital format. These new resources are less rigid than more familiar media and tend to use more of an experiential model than traditional didactic resources. This shift is perhaps most evident in the area of "edutainment," which, unfortunately, exhibits many problems in the quality of both the software and the content we might expect to find in an emerging resource.

The hands-on nature of this third wave, and the openness of the World Wide Web, already presents us with the problem and/or opportunity of the public accessing information resources unfiltered by traditional gatekeepers of knowledge (such as teachers and librarians). I would suggest it is a waste of time to try and close the door by attempting to restrict access to "approved" information sites. While being able to recommend sites with reliable information is important, I think some of the energy of both teachers and librarians must go into teaching more critical evaluation skills to our students (and other users) and encouraging them to bring their own special knowledge and interests into play. If you can find only biased and/or poorly organized Internet sites on biology or Canadian history, then start a class project to create your own site on that subject.

Public libraries may be able to help local schools that lack the equipment or technical expertise to set up their own Websites by working on co-operative projects in which the library server will "host" pages created by a group of students.

Public libraries may be able to help local schools that lack the equipment or technical expertise to set up their own Websites by working on co-operative projects in which the library server will "host" pages created by a group of students. The Toronto Public Library is hoping to set up one or two such "homework clubs" as pilot projects in 1997.

I expect that in a very few years, many students will be coming into my library and asking me to create a link to a great site they just created on wolves instead of asking "Djugotny?"

The Ultimate Field Trip

Canadian Students Inhabit Mars

By SHEILA RHODES

Student Projects Coordinator
The Education Network of Ontario
Ontario Teachers' Federation

Almost 5,000 students from eight Canadian cities are going on a field trip to Mars next spring. They will be joined by teachers, volunteer mentors, and community helpers. The Ontario Science Centre has been the site for a special event called The Canadian National Marsville (CNM) Program for the past four years and will play host to an energetic group of Marsville settlers once again this year. This program is sponsored by the Challenger Center for Space Science Education.

Challenger Center for Space Science Education

The Challenger Center for Space Science Education is a non-profit educational organization committed to strengthening the scientific and technical understanding of middle school students. The founding families of the Challenger Center work with leaders from education, science, industry, and government to create these positive experiences. Challenger Center currently has partnerships with over 28 educational institutions in the United States and Canada. There are Challenger Learning Centers at the Ontario Science Centre in Toronto and the Edmonton Space and Science Centre in Edmonton.

The theme of space exploration is used to create positive experiences that raises students' expectations of success; fosters in them a long-term interest in science, math, and technology; and motivates them to pursue studies in these areas. Challenger Center's objectives are: to teach math, science, technology, engineering, and communications concepts; to demonstrate problem solving using a co-operative model; to arouse students' interest in pursuing careers in the sciences, communications, and technology; to expose students to the complex scientific, technological, environmental, socio-political, and cultural issues related to space exploration, and to promote international understanding among youth and increase students' awareness of, and respect for, multicultural perspectives.

Canadian National Marsville Program

The purpose of the Canadian National Marsville Program is to create a positive vision for young Canadians of the technological society they will inherit in the 21st century. The program shows students how they can play a role in establishing the kind of society they want in the future. Marsville has been designed for students in Grades 5 to 8. While the primary educational thrust of Marsville is science, math, and technology, the project uses a cross-curricular, holistic approach integrating the various disciplines.

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The overall goals of the Canadian National Marsville Program are: (1) to provide teachers and students with appropriate Canadian resources and activities related to space exploration; (2) to facilitate partnerships among the host institutions, space-based communications companies, school teachers, and their students in all sites; (3) to enhance the role of engineers, professionals, and student teachers as mentors with the Marsville teachers in all areas of the country; (4) to focus public awareness of and interest in the Canadian Space Program and science and technology in general; and (5) to increase the involvement of females, both as teacher and student participants and also as volunteer mentors.

During the CNM program, students work in teams in their classes and communicate through fax and Internet connections with their counterparts in other regions of the country. Mentors from the engineering and aerospace industries in Canada work directly with teachers and students in the classroom and online as they design their version of the settlement on the red planet. At the conclusion of three months of classroom activities, students from the eight Canadian sites are joined via video-conferencing equipment to share the results of their studies on LinkUp Day. The centres involved are: the Pacific Space Centre, Vancouver; the Edmonton Space and Science Centre; a science museum in Saskatoon or Regina; the Ontario Science Centre; the National Museum of Science and Technology, Ottawa; a site in Windsor; a site in Montreal; and the Canadian Armed Forces Base, Gagetown, New Brunswick.

How Does Marsville Work?

Classroom Support

Prior to the start of classroom activities, a full-day teacher training session is held in each Marsville city across Canada. At that time, participating teachers are provided with a Marsville curriculum package that includes a teacher's guide, classroom material, support activities, resource lists, electronic connections, and more. This package has been designed to assist in the integration of all subject areas using the theme of space exploration. The material combines content, co-operative learning strategies, critical thinking and problem solving, and responsible decision making. A followup session in early January allows teachers to acquire the necessary telecommunication skills and also meet with their mentor.

Phase One — Preparation for Mars

The Canadian National Marsville Program encompasses educational activities inside and outside the classroom. Specific CNM activities encourage communication between all eight sites. These include the creation of a CNM Mission Patch and the sharing of information and resources across the country. Students are assigned roles within the context of the larger Martian settlement. Mission teams solve simulation-based problems using the Marsville curriculum. Each mission team is partnered with two teams from nearby schools. These teams compose a Habitat Crew, communicating with each other through written and/or electronic means only. The Habitat Crews are responsible for co-operatively designing and constructing working models of the systems and habitats which will house them on Mars. The Marsville systems are: water supply; temperature control; waste management; communication; energy; recreation; food production and delivery; air supply and transportation.

> Throughout the activities, the program focusses on materials relevant to Canada's role in the exploration and development of space and communication technologies.

Several teams undertake the added challenge of creating a Rover vehicle capable of traversing the rough Martian terrain. Under the guidance of personnel from Spar Aerospace, students design a Mars Rover using the LEGO materials and Control Lab software. These teams are showcased during the LinkUp Day activities. The Rovers are then controlled remotely via the Internet through a program sponsored by the Jet Propulsion Laboratory (NASA) in California, Utah State University, and The Planetary Society. This creates opportunities for students to work with the engineers and scientists responsible for the NASA Mars Pathfinder mission scheduled to land on Mars on July 4, 1997.

Marsville lessons address the difficulties of pioneering, past and future; the responsible use of Martian resources; the building of habitats based on the Martian environment and human needs; and issues of working on Mars to conduct scientific experiments and develop engineering prototypes. Throughout the activities, the program focusses on materials relevant to Canada's role in the exploration and development of space and communication technologies. Canada's vital position in space robotics, remote sensing, and earth monitoring are emphasized. This stage lasts approximately eight to ten weeks.

Electronic Communication

Communication is a key aspect to this project as it is in real life. Participants use available technology to link to a common goal, the establishment of the Marsville community. All Canadian National Marsville participants across the country are provided with an account on the Education Network of Ontario telecommunication system. This provides for effective online communication for all partners in the program. The Education Network of Ontario (ENO/REO) World Wide Web home page on the Internet serves as a place where teachers and students can obtain uptodate information about the project and activities related to Canada in space. This interactive Web site allows for studenttostudent conferencing, online mentorship, and the sharing of information.

Phase Two — Link-Up Day

On April 26, 1997, all the mission teams in each of the Canadian sites gather to construct their own Marsville settlement. Crews set up their physical solutions to the specific Martian biological or social system previously assigned to them. Students share their problem-solving strategies, their successes and challenges, and work on their final project — the governance of Marsville, the Cosmic Village. On Link-Up Day, the eight sites are connected through advanced video-conferencing technology to allow the explorers to "meet" their fellow space travellers across Canada and to compare solutions. A live link with the Johnson Space Center in Houston connects members of the Canadian Astronaut program with all CNM sites. The Marsville settlers are given advice and suggestions from this team of space explorers. In addition, several astronauts spend the day at a LinkUp site working along with the student explorers.

Partnerships

Strong partnerships between various government agencies and private industries are well established. The national sponsors of the program are Spar Aerospace, the Canadian Space Agency, Challenger Center for Space Science Education, and the Education Network of Ontario. Additional support is available from organizations such as the Association of Space Explorers, the Canadian Aeronautics and Space Institute (CASI), the Canadian Alumni of the International Space University (CAISU), Comdev, Macdonald Detweiller, The Planetary Society, The Innovators in the School Program, and several faculties of education in Ontario. Local support is provided by each of the host institutions. Community involvement includes supplying materials for LinkUp Day, encouraging guest speakers in classrooms and participating in a range of activities.

Summary

The Canadian National Marsville Program is a truly unique adventure. It provides real-life education for all participants. Students become more aware of the importance of space education, discover the role Canada has played in the past and continues to play in the space program, and develop a sense of pride for the accomplishments of Canadians in the space field. The 1996 CNM Mission Statement serves as testimony to the value of this program.

> Students in the Canadian National Marsville Program will be challenged to the best of their abilities:
>
> - to build a caring and equitable community in a new frontier
> - to acquire the technological skills required for the 21st century
> - to preserve the Canadian spirit of courage, risktaking, and creative problemsolving
>
> This will be done through co-operation and a positive attitude for the benefit of all humanity.

For further information about the Canadian National Marsville Program or Challenger Center for Space Science Education, contact Sheila Rhodes, (416) 966-3424 x 622, sheirhod@enoreo.on.ca.

Wire the Muses Cautiously

Challenging Traditional Roles of Art Museums in a knowledge-Building Society

By DOUGLAS WORTS

Educator and Evaluator
Art Gallery of Ontario

Across the continent (and beyond) art museum staffs are a-twitter with excitement about the potentials of the digital world now available on the Internet — art images on demand, exhibition previews, research possibilities, curriculum-related materials, online museum-shop purchases, and much, much more. Underlying this excitement are two basic thrusts: (1) an interest in seeing more people become increasingly involved in the "cultural world"; and (2) an interest in increasing revenues in a world of declining public funds for the arts. With these motivations in mind, museums are developing sites on the World Wide Web (WWW) at an incredible rate. We must, however, ask if this collective jump onto the technology bandwagon is actually moving art museums forward into a position of greater relevance within our society.

A desire to boost public involvement and income is currently a fairly universal motivation for being on the Net but is not sufficient to ensure success. People who have access to Internet technology and surfing skills have limited time and energy to visit sites, so the ones they return to will have to be amazing and relevant indeed. There is no doubting that network technology will have a lasting and important impact on our present and future society; however, the delirium surrounding getting online is generally out of touch with both the real potential for creating new forms of meaningful cultural experiences and with the reality of actually sitting at a computer, typing in WWW addresses, hitting "hot" buttons, and waiting for pages to load. The current bandwagon phase of museums becoming "wired" will likely result in a lot of activity, a few successes, and many failures.

As cultural organizations with educational mandates, art museums need to proceed with great clarity and caution into the world of public-access, network technology. I say this not because anything particularly bad will happen if we don't get it right. Rather, it is more because we may not have more than one kick at this expensive technology can. I believe that there is real potential for museums to utilize technology in becoming more important players in people's lives, through direct connections to schools, workplaces, and homes. But this will require a transformation of, not a simple extension of, what these cultural organizations have been doing for over a century.

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If we look at some of the audience research conducted in recent years, we find that less than a third of Canadians visit art museums on an annual basis or more — the vast majority of whom don't visit more than once in any year (Cheney, 1992). These statistics suggest that art museums are, for most people, a kind of infrequent, leisure-time distraction. Little research has been conducted to answer the question of what impact such a visitation rate has on the lives of visitors. Yet, it seems reasonable to assume that the typical public offerings which drive current visitation patterns probably will not provide a good foundation for public-access network technology applications.

So, why are most museums that are building Web sites focussing their energies on digitizing images of selected works from their collections, providing snippets of information about the importance of those artworks, and advertising the hours, admission rates, and resources available at the museum's location? Is it because many museums still believe that, "if only the public really knew what happened at our institution, they would want to visit"? Whatever the answer, there are much richer possibilities for interesting dynamics through technology, if museums could see beyond their traditional functions and engage the most pressing cultural needs of the community, including both artists and non-artists, historians and non-historians.

Take, for example, the possibility of a set of networked databases that are built co-operatively by numerous classes at the public school level, researchers at a university, as well as professionals at a major art museum and a science centre. If these databases were designed to be linked and to grow according to the interests and passions of the people involved and were supported by a true interactivity which encouraged discussion and exchange between people in all of the participating organizations, the databases would quickly become powerful resources for linking the needs, interests, knowledge ,and wisdom of the large group. If this notion of "knowledge-building," based on both a philosophy of respect for and interaction between all participants, as well as a belief that insights into problems are not the exclusive domain of "experts" in related cognitive fields but rather can come from artists, children, or others, then a true transformation of the roles of schools, art museums, and science centres might take place.

This scenario is exactly what is being planned as one part of the TeleLearning Research Network initiative, a federally funded National Centres of Excellence Project. Specifically, the Centre for Applied Cognitive Science at OISE/UT is working with several networked school classes, the Art Gallery of Ontario, and the Ontario Science Centre to prototype the idea of a "knowledge-building society" in which each of the partners shares their information resources and internal reflective processes in ways that is mutually beneficial to all partners (Scardamalia & Bereiter, in press a; Scardamalia & Bereiter, in press b; Scardamalia, et al., 1989).

Such a shift in thinking about what an art museum could be requires a fundamental rethinking about and re-articulation of the potential of art and creativity in our society (Worts, 1996, 1995). To pursue this shift, we need to ask the difficult question "What value does art have?" — both in relationship to individuals and to collectives. If we acknowledge that artists past, present, and future create objects that function as symbolic mirrors for society and which provide penetrating insights into the world we create for ourselves, then art museums have every potential to function as a truly effective link between a largely disinterested public and a vital social phenomenon. It is exactly here, in this facilitating function, that network technology can allow greater and more integrated contact between a public, the creative arts of humanity, and the issues that constitute compelling focal points in our everyday lives. The technology is a vehicle not only for information distribution but also, more importantly, for communication about the meaningfulness of our lives and experiences.

Contemporary society is increasingly troubled by a sense of disconnection from cultural identity. Despite the growing sizes and multicultural natures of our cities, most people are searching for meaningful ways to connect to others — ways that are not solely defined by the pragmatics of our increasingly frantic work schedules. Art museums have the potential to be grounding points for such experiences (although this is not their traditional role), and technology has the potential to provide a communication infrastructure to help facilitate personal reflections and productive, multilateral communication. It makes good sense that this infrastructure would enable direct, regular, and easy communication between and among school classes and museums. And if the nature of this connection were through relevant issues and themes then the museums may be able to connect current realities with some of the timeless themes that have been at the core of human experiences throughout time.

In this spirit of supporting a more holistic and lived notion of cultural dynamics (as opposed to the fragmented, object-based versions of culture that are usually presented by institutions of culture), museums could begin to utilize not only Web technologies, but also television, radio, popular press, and more to extend their reach and their impact. Such a use of technology would go far beyond the traditional model of the museum expert making pronouncements about the importance of selected artworks on behalf of a whole society. This is not to demean the importance of experts who are skilled and knowledgeable people who offer insights into cultural objects; rather, I am suggesting a greater balance in the way that these objects come to be meaningful whithin a society. If cultural materials were presented more as points of experience, discussion, and debate, rather than as idols that sit in rarefied shrines, then perhaps more people would engage in the dialogue and, in turn, contribute to the vital meaning-making process that lies at the heart of cultural exchange.

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To this end, it may be possible for a museum's Web site to become a place where perspectives on important issues, like identity or the environment, are exchanged and debated. Here, works by contemporary and historical artists would help illuminate the personal and collective insights into these issues that come from the creative process. Alternatively, the Internet may be a place where cultural objects, places, rituals, and beliefs that are meaningful for different communities with-

Support from MET

The Ontario Software Acquisition Program Advisory Committee (OSAPAC) has a budget of $3.4M for provincial software licenses in 1996–1997.

The Technology Incentive Partnership Program (TIPP) is designed to foster partnerships between school boards, the community and private sector to implement projects that use information technology to improve education in ways that can be readily introduced to other schools.

The Ontario Government has committed an additional $20 million in 1996–97 for a second round of TIPP proposals (TIPP2) during the fall of 1996. TIPP2 will focus on improvements in learning in Grades 1, 2, and 3. Province-wide Grade 3 testing will provide an early and useful benchmark on the effects of computer technology in the classroom.

The Grant Eligible Microcomputer Systems (G.E.M.S.) program provides targeted funding for purchase of classroom computers, technical support and software. In 1996–1997 the funding was $36.4. Over the past three years, the Ministry provided $4M to the Educational Network of Ontario (ENO/REO), which offers moderated computer conferencing, E-Mail and Internet access to Ontario's teachers.

The Ontario Curriculum Project of the Curriculum, Learning, and Teaching Branch is field testing an electronic version of the provincial report card and will soon release an updated ONeducation CD-ROM and later an electronic curriculum unit planner.

The MET Website address is **www.edu.gov.on.ca** in our multicultural society could become focal points, as a way of honouring the many groups that share our environment but which cannot currently be represented adequately in the physical museum. There are many possibilities for better integrating the visual and creative arts into the lives of individuals, but most of them require that the traditional roles and structures of museums be challenged, reviewed, and altered in accordance with the needs of our society. This is no easy task, especially since most people believe that museums as we know them are inherently worthwhile — even though they don't often derive personal benefit from them through actual visits (Cheney, 1992).

Since technology comes with such a high price tag, in hardware, software, communication infrastructures, and human resources, it is important that art museums think long and hard about what they want this technology to facilitate. In its fullest sense, the concept of the museum suggests a place where any individual can come in contact with the mysterious and unknown realms of the human psyche. Physically, museums may be places with special objects that have evocative powers. But psychologically, museums may be described as inner archetypal worlds of imagination and possibilities — places where the timeless powers of gods and goddesses assert themselves in countless ways. Putting a museum online is one thing — as we have seen repeatedly on the Internet — but wiring the muses is another undertaking altogether. And it needs to be done with care and caution.

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E-Stat in the Classroom

A Teaching Tool from Statistics Canada

By JIM MUMA

Educational Consultant

Computers in the school classroom are vital in this emerging information age. What programs and equipment are needed to ensure computer literacy for students in their preparation for the future? Given today's fiscal realities, it is utopian to believe that all schools and classrooms will have leading edge equipment with which to work. With funding at a premium, the need for an educational tool that fills as many niches in the curriculum as possible is a prime consideration for both educators and tax payers. Using this criteria, I believe that E-STAT from Statistics Canada serves the school systems well.

> How many teaching tools are useful in history, geography, health, family studies, economics, and statistics? E-STAT is limited only by the imagination of the user.

This product, which has been in development since 1986 and was first available as an annually issued CD-ROM in 1992, is always timely and current. E-STAT's collection of databases, compiled from most subject areas of Statistics Canada, has applications for most subjects, across most grades. The ability to be useful from junior high to post-graduate studies is not a common occurrence in software programs. How many teaching tools are useful in history, geography, health, family studies, economics, and statistics? E-STAT is limited only by the imagination of the user. Such bold statements would be, for many, a thrown gauntlet to be picked up as a challenge. When first introduced to E-STAT, I felt the program could not be as good as stated!

My classmates and I in the Faculty of Education, University of Windsor, set out to see if there was a subject that could not be remotely tied into E-STAT. We wondered about language arts/English until an English major pointed out that a report, paper, or project being produced by a student is in itself an exercise in this area. E-STAT can illustrate the socio-economic climate within which an author has written a particular work or the period about which the author is writing. The adaptability of E-STAT was later reinforced when I used E-STAT in an OAC economic geography class.

What Is E-STAT?

E-STAT is a collection of databases compiled from information that Statistics Canada collects and processes under its mandate as Canada's national statistical agency. The package I used, E-STAT 1995, had six major areas:

- the CANSIM Time Series, a collection of 300,000 economic, business and social indicators concerning such areas as: population growth, immigration and cultural diversity, crime and health, economic indicators, price indexes, Canadian business, industry and agriculture, family expenditures, and the World Health Organization Cross-National Survey, which looks at issues and topics as answered by 11, 13, and 15 year olds, and much more
- 1991 Census Profile, with socio-economic and demographic data on over 6,000 geographic areas
- 1986 Census Profile, containing the same range of data
- 1991 Census of Agriculture, covering most areas of concern to modern agriculture
- the 1991 Aboriginal Peoples Survey, a look at how they see their position in society along socio-economic line
- environment, human activity data which have an impact on the environment, for drainage basins and ecoregions

E-STAT is available in DOS and MAC

versions and is extremely user-friendly as it has a menu-driven format. Users can search for topics, retrieve the data, manipulate the results and then display them as tables, charts, or, in the case of census information, as maps.

How Have I Used E-STAT in Education?

How does this fit in to a curriculum and class work? Let me share my successful experiences with E-STAT in an educational setting.

For an OAC economic geography class, the assignment required the students to use data from both the 1991 and 1986 Censuses (available with E-STAT) to select and construct population graphs for a province and reflect how the dependency groupings were changing. Second, using the socio-economic data from CANSIM for the same province, they were to choose a population characteristic, such as Asian immigration, and an economic variable, such as imports of food from Asian countries. This could be extended further to see how the balance of trade between the various regions was represented. The students were then to explain how they felt the data were related and what could be projected for the future using their analysis. The students rose to the challenge, using the three lab days to find and print out the figures, matrices, and graphs.

What benefit did the students develop during this task? Debriefing and general comments showed that the enthusiasm level was quite high. The co-operative aspect of the activity was evident in the more computer-literate students assisting the others in their journey through the data. The students were given a well-defined but unstructured task that allowed them to tie in the knowledge from the course, their own personal interests, and the hypotheses that were formed in their imagination. The task used abstract thinking in forming the hypothesis. The students had little or no experience in the economic areas they would examine and had only their own idea of what might be found during the discovery phase. The comparison of seemingly unrelated data required the students to ask themselves such analytical questions as: What was the meaning of the separate figures, and how did they reflect a socio-economic or human pattern when linked together? Would growth in the economy as indicated by the data support new businesses in that sector or would the existing businesses do better to expand, or neither? The final results were analyses of factors that showed the dynamics of various sectors of this country's economic life, and analytical thinking by the students.

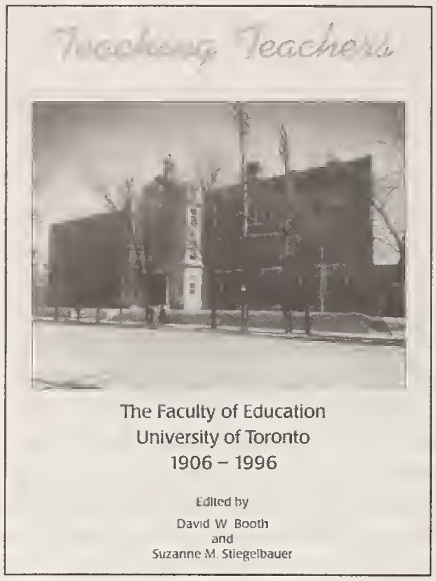
At first, the students appeared to believe that they were being given three days to play with a new toy. I did nothing to dispel this mind set, wanting to see what the result would be. I found that the students soon realized that this was work, and after completion, that the work was not the drag they thought it would be. The students indicated that the hardest part of this task was staying within their own imposed limits for the submission. The thoroughness of the submissions resulted in marks ranging in the upper B to upper A grades. It was a thrill to watch the students explore, digest, and relate topics, that, before the task was given, were new to them.

E-STAT '96 has a bonus that is historic, both figuratively and actually. It is information available electronically to teachers for the first time and it is Jean Talon's Census of 1665–66 and the last pre-Confederation Censuses of 1860–61. As a graduate historian, I am excited by the possibilities of these historical databases. History teachers will be able to transport their students back to the mind set of the people of that time. First, the formation of the Census questions tells us what information was pertinent. Second, we can see what constituted wealth or economic well-being then by assessing the questions and categories of that time. Third, and decidedly the most important to me, is the freedom for the students to postulate and explore ideas and questions on their own, or as part of a co-operative effort, and develop the inquisitive nature important to the students' growth.

Personally, I feel this teaching tool deserves to be in every classroom. I would mention here that E-STAT is already in over 2,000 schools. However, I have found that many teachers are not aware of E-STAT's already being in their school nor of how to use it in their delivery of the curriculum.

I feel so strongly about this program that I will give my children unrestricted access to it, to allow them to learn about themselves, their society and their country, and I would hope that others get the same chance. After all, as educators and parents we must believe that knowledge is the key to a better future, and E-STAT will help bring that knowledge to individual students.

The Ontario Ministry of Education and Training has a provincial license for E-STAT that reduces the price to Ontario public and separate schools to $50 (and $150 for the optional add-on modules). Call Statistics Canada at 1-800-263-1136, or look for E-STAT on the Internet at WWW.STATCAN.CA in the Electronic Marketplace under Products and Services.



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Hands-On Experience for Students at TG Magazine

Respect, Technology, and the Business Mode

BY STONEY MCCART

Publisher, *TG Magazine*

At our organization we start from the premise that young people are an underutilized resource — in our educational system and in our society. Our experience is that young people learn more effectively when they see what impact their theoretical learning can have, on themselves and on the world they live in, through the concrete achievement of specific tasks related to the real world and real-world deliverables.

At *TG Magazine* and its sister program, The Students Commission, our frameworks and processes are based on hands-on experience that comes from running training programs in businesses, from teaching in the classroom, from community service work and from front-line production work in the magazine, TV, book and radio world. Our adult team consists of media and publishing professionals, teachers, youth counsellors and artists, and service club volunteers. Teachers volunteer with us in the summers and during the school year in order to gain experience and expertise.

Our youth staff consists of high school co-operative education students from most boards in the Greater Toronto Area, youth volunteers and advisors from across Canada, as well as part-time and summer youth employees, pulled from across the country. Our ratio runs approximately 20 percent adult to 80 percent youth. We are currently in an expansion program that may see us employing up to 35 young people across the country, as well as our core group of about 15 high school co-op education students.

In addition, we work with satellite schools across the country, assigning them aspects of a project to do (such as a video sequence for a CD-ROM). We are constantly building and experimenting with technology to develop better ways of making these collaborations more effective, and we assist schools to put the professional culture in place so that their students are motivated to put forward their best efforts. Teachers tell us that it is motivational for students to have a destination for their work outside of the traditional school marking structure.

Our business is communications; we produce magazines, CD-ROMs, youth conferences, workshops, videos, web sites, learning resources, systems and programs. We train our young people to be consultants on youth, speakers, workshop deliverers, artists, entrepreneurs, and multimedia designers.

TG Online, a weekly teen internet magazine, publishes the work of students. Other TG formats include video clips, still photos, art on CD, and print and CD workbooks. Find out more about *TG* communications by calling (416) 597-8297 or by looking us up at our Internet address:

www.tgmag.ca.

Our clients are attracted to us, because our products are targetted to the youth and education markets, and our product is focus tested in its very production, by the very people who will use it. But, and I will stress this, our process is different because it is a true partnership of youth, business professionals, and teachers working side by side — not simply politely consulting one another at disparate, separate stages along the production path. In our experience that kind of collaboration is not as effective, not as good a learning experience for any of the parties. Often, because the parties don't really understand one another, it is not very effective in truly shaping a communication product which reflects the expertise of each collaborator.

We are a bit of middlearth between the world of business and the world of education, with staff expertise from both. In our view, the world of the future will see the classroom inside business and business inside the classroom to the benefit of each. Business has continuous education and retraining needs for its employees. We also think that members of the education industry will begin to enjoy themselves again when they come to understand that they too are part of a huge industry that is undergoing the same retooling, restructuring, and readjustments which every other business in our economy has been undergoing.

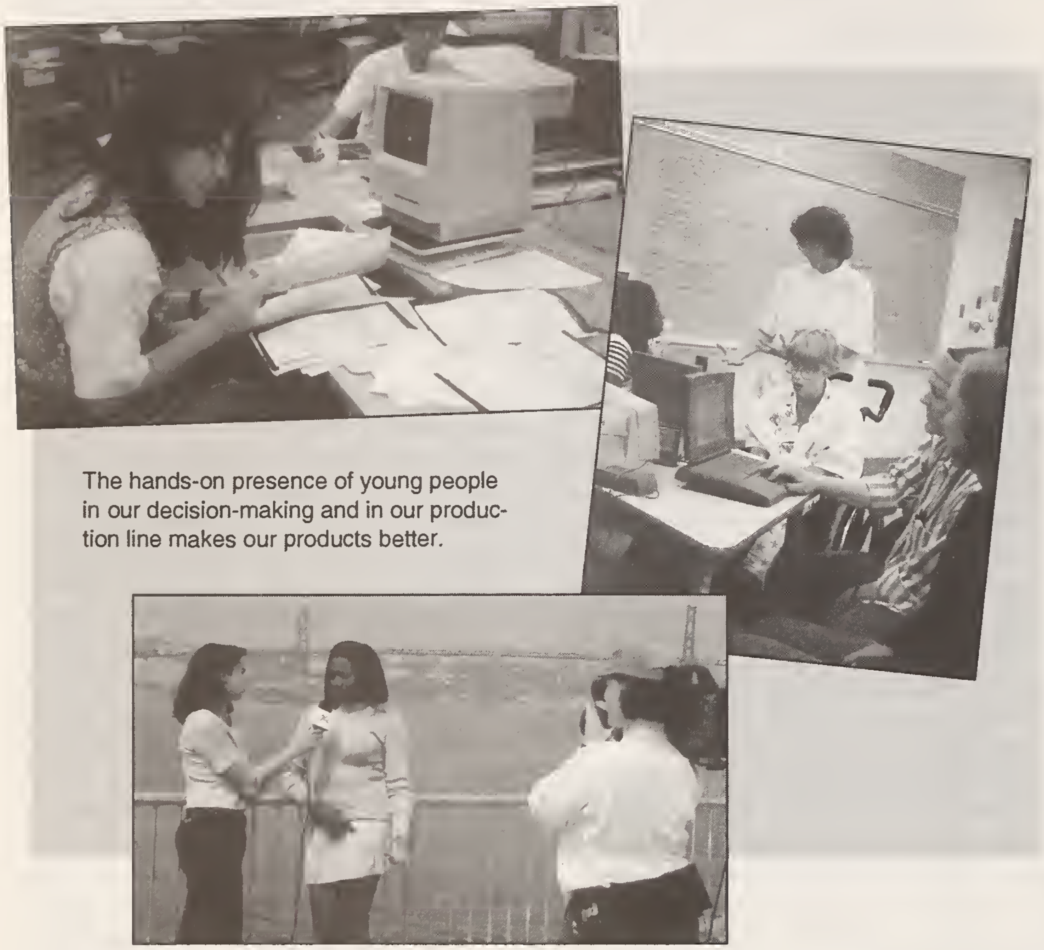
No other industry in today's modern world has been as ghettoized, and unchanged by technology and structural readjustment, as the educational industry. This, we think, is in itself one of the greatest barriers to effective partnerships between business and education, and even to bringing today's working parents effectively into the educational system. Today, business and education don't even talk the same language, even when they are saying the same thing; business people look blank when educators talk about learning outcomes, while teachers squirm in their seats when business people ask for deliverables.

When you walk into our office you will see small pods of computers, grouped by function: writing text machines, desktop design, web design, scanning, multimedia, phone and research tables. It looks high tech, but technology is only a tool. And it's not top of the line; we have yet to throw out a computer. The text machines are 1986 SEs. More than 50 percent of our training and employee support time is spent on messaging and content, people communications skills and collaborative teamwork skills, rather than computer training. All our projects are handled in a collaborative approach.

The operating model is similar to one I helped run as the supervisor for the training division of a large Canadian magazine company. There, we trained every entering editorial employee before they were placed on a magazine staff. We had a permanent senior staff who functioned as liaisons with corporate clients and an ever-revolving cadre of trainees who did the work of the division. From the division we produced about 12 different corporate newsletters, 8 monthly magazines, and bailed out all of the company's magazines if they had emergencies, sick employees, or a deadline they needed help with.

We think that with the equipment being placed in schools today, many schools could be running very similar, effective communications with their communities — a real world deliverable.

Our young people — high school and older — work directly with clients and are responsible for producing material for them. We have four key concepts as an organzation: listen, respect, understand and then communicate. It is as important to learn how to respect and understand each other in order to work together effectively, as it is to respect and understand the needs of our clients in order to produce effective communication tools for them.


The hands-on presence of young people in our decision-making and in our production line makes our products better.

This spills over into our mode of operation; if we have a rule, then it applies to all, adults and youth alike. For us this sets up a standard of respect and a working atmosphere which eliminates both discipline and motivational issues. In our more than 15 years of running our youth-driven program and business, it is this theme of being respected and treated as equals that youth cite as the significant difference from anything else they have experienced.

They learn as they do; just as we adults do. If a new computer program comes along that we have to learn, we crack open the manual and learn it together. They soon learn that they can be the experts, as fast, often faster, than we can.

Our means of operating is to understand fully and completely for our target audience and client the message that needs to be communicated. This involves discussion, research, and understanding. Then our challenge is to pick the appropriate medium or media for the message or the aspects of the message that are appropriate for that medium. Our young people are soon discovering how to adapt messages and prepare and present them in print, video, web, radio and CD-ROM formats, using text, art, music,voice-over, drama, photography, animation, and video. The technology is exciting, motivating and challenging, but the most important aspect is that students are working and reworking content, constantly analysing the relationships between the content, the media they are using, and the people they wish to communicate with.

Our mission has been to publish the voices, ideas and opinions of young people in a wide variety of media, and to provide the resources, skills development, and professional guidance young people require to develop effective learning resources — by young people, for young people. A subsequent outcome has been the development of learning activities and programs which allow schools, teachers, and classes to work collaboratively with us on projects such as CD-ROMS, print magazines, and web sites from anywhere in the country.

With this staff and network, both paid and unpaid, we create and maintain probably one of the largest, non-governmental, bilingual web sites in the country, organize and execute high profile youth conferences, workshops, and a youth speakers bureau, and do contract publishing and multimedia solutions for clients like TVO, Bell Canada, Canadian Heritage, Spar Aerospace, UNICEF and the Canadian Coalition for the Rights of Children and Youth.

Our experience is that the hands-on presence of young people in our decision-making and in our production line makes our products better, gives us fresh ideas, and ensures that we are relevant and effective in the materials and programs we produce for our clients. In today's fast-paced, high-technology world, young people are less afraid and less resistant to change, more adaptable and more intuitive about the applications of technology.

We spend some of our time actively encouraging other businesses and organizations to run as pro-active a youth co-op and employment program as we do and have created an Employers' Manual and Workshop that we give to assist businesses to run effective co-op programs.

Although the name of the publication, and now even the medium has changed, we can with pride say we are still true to the orginial editorial mission published in the first issue, created by high school students in 1940 as *Canadian High News*: "The foundation of this paper is threefold: We believe in democracy; we believe in Canada; we believe in ourselves, the younger generation." You can find out more about how to work with us at www.tgmag.ca.

PS: one of the founders was Robert McMichael, who after establishing *Canadian High News* went on to establish The Gallery for the Group of Seven.

Section 4

TEACHERS' LEARNING

What are the needs for professional learning?

◆

What have we learned about effective PD?

◆

What kind of PD is needed to support the effective use of the new technologies?

◆

How can technology contribute to the process of professional growth?

◆

Action Research and Teacher Networking

The OPSTF Sponsored Common Curriculum Innovation Fund Project

By LINDA GRANT

Executive Assistant
Ontario Public School Teachers' Federation

Project Overview

In June 1995, the Ontario Public School Teachers' Federation launched a large-scale curriculum-implementation project. The project's aim was to involve teachers, supervisory personnel, and community stakeholders in the process of implementing systemic change. The project focussed on two global strategies — action research and teacher networking.

Action research operates on the premise that productive curriculum implementation is achieved when there is a strong link between research and classroom practice. It endorses the concept of the teacher as both researcher and practitioner. In this dual role, the teacher in the ongoing process of improving personal practice is able to investigate issues facing education today and is well positioned to have a direct impact on change in the classroom. The OPSTF project encouraged teachers to undertake the role of researcher/practitioner working in concert with principals, superintendents, and members of the school community.

Participants identified significant issues related to the implementation of *The Common Curriculum*, prepared a process of inquiry, collected and analysed information, reflected on the findings, and shared results with other colleagues and with their communities. The project participants also made their work more publicly available through presentations, electronic media, journal articles, and a text compilation of their work.

During the course of the project, participants communicated via face-to-face meetings, audio and video conferencing, as well as through e-mail and a computer conference.

Outcomes fed directly into the project's second focus: teacher networking. A diverse collection of information about the teaching and learning process in the context of *The Common Curriculum*, as well as instructional materials grounded in classroom practice, were shared by project participants with others outside the project. This ongoing sharing was an important feature in generating interest on the part of other teachers and administrators. Teachers became the resource core for others interested in initiating action research projects.

Four Ontario Boards of Education participated in the project: Waterloo County, Brant County, Nipissing, and East Parry Sound. Ongoing support was provided by OPSTF staff, OISE/UT, the Faculty of Education at Queen's University, staff from the TVOntario Curriculum Project, as well as Jack Whitehead from the University of Bath, Great Britain. The project was funded through the Ministry of Education and Training Common Curriculum Innovation Fund.

Participants in the Ontario Public School Teachers' Federation-sponsored Common Curriculum Innovation Fund

Project wanted to learn through their own research projects. They wanted to improve classroom practice based on personal investigations of relevance to themselves. They wanted to reflect on their teaching and learning environment, whether it be at the classroom, school, or system level in a systematic way. And — in the end — they wanted to share what they had learned. The project participants believed they had important information to share with their colleagues, students and parents, principals, system administrators, and policy makers. They had a voice and wanted to be heard in the role of advocates for effective practice in education.

This article focusses on the teacher-networking aspect of the project. There are, already in existence, several excellent print resources available outlining various strategies on how to begin action research initiatives in schools and classrooms. The OPSTF project report also highlights the specific experiences of teachers, principals, and superintendents over the course of the Innovation Fund initiative. We experienced first hand what works — and what doesn't! Participants were most straightforward about sharing both first-run successes and those experiences which provided the foundation for growth.

One of the more interesting questions I have asked myself about this project is "Why has the notion of action research been so enthusiastically embraced by participants?" Many of them are now "borderline messianic" in their testimonials and writing. The answer, I believe, lies partly in the fact that improving practice through a process of systematic inquiry makes sense. The second part of the answer lies embedded in a more deeply rooted cultural phenomenon. The participants in the project are demonstrating the particular social, political, economic, and cultural characteristics of educators functioning in a "postmodern" world.

Hargreaves (1994) identifies seven dimensions of the postmodern condition that are influential for education and teaching. He lists the following:

- Flexible Economies
- The Paradox of Globalization
- Dead Certainties
- The Moving Mosaic
- The Boundless Self
- Safe Simulation
- Compression of Time and Space

Prior to beginning my discussion of the networking aspect of the project in the context of these terms, I should like to be very clear. Everything did not work 100 percent well. It was not all wonderful. Not all our participants were computer literate. The computer network we were using didn't always work. We had school closures because of blizzard conditions on days when our audio conference sessions were scheduled. Some teacher participants were unable to attend the face-to-face sharing sessions. Some participants were unable to find colleagues in the same school willing to act as "critical friends." Overall, however, the project did generate enormous synergy. Participants strongly believe that the experiences this year were "only the beginning." They are determined to continue their work as action researchers in the future. And they are determined to continue to be very public about what they learn.

They used technology in constructing networks within and outside their own schools and boards of education. Everyone involved — teachers, parents, students, principals, superintendents, and project support people — was a learner.

Flexible Economies

Hargreaves (1994) writes: "One of the most central defining and determining characteristics of the postmodern, postindustrial order is a new and distinctive pattern of production, consumption and economic life." Flexible economies, he suggests, create important teaching challenges as we try to ensure our students have the knowledge and skills to be successful in a world that values flexibility, adaptability, collaborative working relationships, and continuous growth and change.

The Innovation Fund Project provided participants with opportunities to form new patterns of professional behaviour and new work relationships. In addition to the traditional forms of teacher in-service, participants were involved in a new way of learning. The issues were of personal interest. They were based in daily practice. The investigative processes were self-selected. Support was provided on request. Revision was a natural part of the process. Reflection and journal keeping were the norm. The "experts" were the teacher participants and their critical friends.

They used technology in constructing networks within and outside their own schools and boards of education. Everyone involved — teachers, parents, students, principals, superintendents, and project support people — was a learner. In essence, the participants become role models for continuous growth, adaptability, flexibility, responsibility, and accountability. Participants, operating within the project network, paralleled and modelled characteristics consistent with effective networks.

> ... Networks shift the meaning of adult learning away from prescription, toward challenging involvement and problem solving. To do this they model different modes of inquiry; supporting the formation of teams or task forces, finding mechanisms to encourage cross-role group discussions, focussing deeply on tough, seemingly intractable issues, and inviting participants to help shape the agenda in their own terms. (Lieberman & Grolnick, in press)

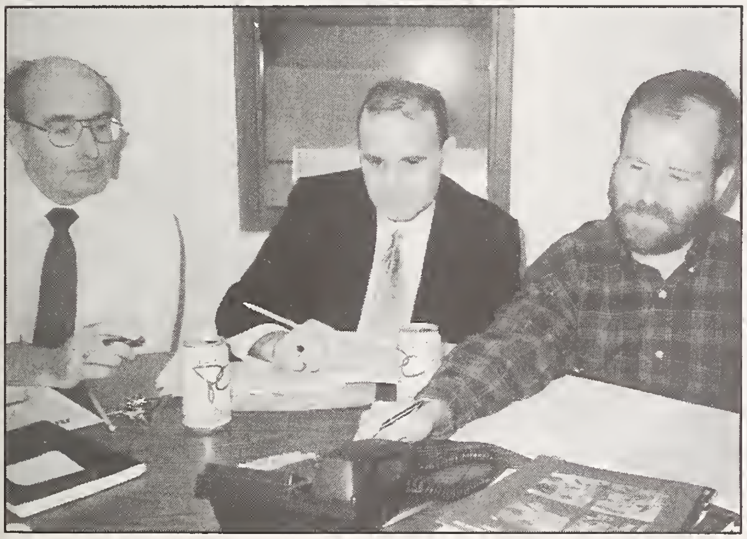
The participants were also role models for their students who must learn similar skills in order to function successfully in their postmodern world.

The Paradox of Globalization

Teachers accept the idea that students, in order to function successfully, must be able to think about the world in both local and global terms. Few teachers think about the world of education in the same terms. The challenge, in this project, was to encourage participants to focus on *both* the instructional outcomes specified in the Ontario Ministry of Education and Training's document *The Common Curriculum* and broader concerns related to the teaching/learning process and action research.

One of the fundamental principles of action research is the process of reflection, both on and in practice. At the same time, participants must look through the

Christopher Laver (left), Grand River Collegiate Institute, working with teachers Peggy Dieterie (centre) and Gillian Lambert, Smithson Public School, Waterloo County Board of Education.



◄ Principal, Doug Richardson (left), Banbury Heights School, Brant County Board of Education and teachers, Jeff Churchward (centre) and Ed Wilson discussing the Common Curriculum.

window as well as into the mirror. The windows in this project opened out to the world. Through the use of computer-conferencing technology, the potential existed for participants to discuss their work with teachers in other boards, resource people from two Ontario universities, professional development staff at the teachers' federation, and international resource people in Great Britain and Australia. They could read a book on the action research process. They could work with a school action research team. *And*, as part of their learning, they could access the action research conference from Bath University, Great Britain on the World Wide Web. Participants could think about the Ontario-mandated curriculum in terms of both the local classroom, school, and system agendas and the international educational milieu.

Derrick de Kerckhove describes this convergence through the use of computer networking as a "new, unprecedented possibility, ... plugging individuals and their special needs into collective minds" (de Kerckhove, 1995). It is also an example of how educators can inform their practice through both centralized and decentralized resources.

Dead Certainties

Teachers were always supposed to have all the answers. Now, no one has all the answers, and the answers we do have are often changing. Hargreaves (1994) reminds us that "in society as a whole we are experiencing a shift from a small number of stable singularities of knowledge and beliefs to a fluctuating, ever changing plurality of belief systems." Teacher confidence in mandated curriculum and instructional methodology is in decline. Educators encounter a proliferation of approaches to teaching, much of which is contradictory. Many of these approaches generate conflicting public reaction, competitive resource materials for classroom use, and added expectations for teacher in-service. Cynicism and doubt pervade our classrooms and schools.

Action research provides for a multiplicity of approaches. It allows for choice and situational decision-making. It develops the skills and the knowledge base from which informed decisions about instructional practice can be made.

In the early stages of this project, participants experienced some difficulty linking the question they wished to use as the focus for their research and the learning outcomes delineated in *The Common Curriculum.* The questions they chose as the focus for research were legitimate and worthwhile. They represented the particular interests and needs of the individual participant.

In-service in how to link these questions to *The Common Curriculum* was provided through audio-teleconferencing technology. Project participants in all four participating boards of education were linked together for a 90-minute teleconferencing session with Ron Wideman and Ruth Consenheim who were at TVO at this time. They worked through a process with participants that demonstrated how participants might identify both the Essential Learning Outcomes and the Specific Learning Outcomes relevant to their research question. Without exception, project participants were able to ground their research in the outcomes specified in *The Common Curriculum.* They were able to explain their "gut interest and concern" as educators in the context of a mandated curriculum document. For many teachers, this stage was critical. It gave legitimacy to what they were doing instinctively.

In terms of "dead certainties," the action research process gave legitimacy to their inquiry and doubt. Action research supports critical thinking about what is presented as certainty. It provides for both reaffirmation and continuing inquiry on the part of the educator. It conveys the notion that it is "OK" to question, discuss with colleagues, alter practice, and make informed choices about how the implementation of a mandated curriculum document should proceed.

Those participants who were proficient in the use of technology could operate in a "just-in-time" learning mode. They could access information and resources when they needed it. De Kerckhove (1995) believes that through what he refers to as

> sophisticated neural networks with rapid learning curves, you don't need to be an expert in anything. Your best resource might well be your own ignorance forcing your attention to reposition itself to learn what you need from the unique angle of a non-expert.

The participants in this project were engaged in the process of implementation in a meaningful way. Through a combination of face-to-face meetings and technology-supported networking, they learned to work interdependently, value one another's expertise as well as their own, and to respond in new ways to the ongoing challenges in their classrooms, schools, and systems. They understood, and came to accept, that the implementation process for *The Common Curriculum* was far more "uncertain" than "certain"!

Moving Mosaic

Postmodern organization is characterized by networks, alliances, tasks, and projects rather than by relatively stable roles and responsibilities which are assigned by function and department and regulated through hierarchical supervision. (Hargreaves, 1994).

One image of the teacher predominates — a lone individual in a classroom with approximately 30 students. One teacher, one classroom. One principal, one school. One superintendent, one board. Networking through the OPSTF-sponsored Common Curriculum Innovation Fund Project fostered "multiple professional personalities." Participants were educators, learners, mentors, critical colleagues, researchers, authors, technology users, provincial curriculum analysts, collaborative team members, system planners, and participants in the international community of action researchers. They moved from one role to another to play individually and collectively with ideas and information. They functioned collaboratively within the mosaic of action research. This collaboration took place in person, in print, over the phone line, by e-mail, and by video. They moved, irrespective of status in the system hierarchy, through the mosaic with need and with ease, searching out and creating new understandings and knowledge.

Technology helped to level or "even out" the normal hierarchy and bureaucratic power as teachers, principals, and superintendents struggled together to access new networks and resources. All participants were learners striving to enhance student learning through a powerful vision of how action research and networking could assist the curriculum-implementation process.

Postmodern organization is characterized by networks, alliances, tasks, and projects rather than by relatively stable roles.

The Boundless Self

Living in the postmodern world means that we see ourselves differently. "The fragile self becomes a continuous reflexive project. It has to be consciously remade and reaffirmed" (Hargreaves, 1994). Project participants focussed on one another's strengths. They demonstrated respect for one another's work, tolerance, and trust. They took risks by discussing their research in a public forum, in print, and online. They posted questions, gave advice, expressed opinions, and made suggestions for improvement. Participants expected to grow — and change — through their involvement in the project. In fact, as confidence grew towards the end of the project, participants demanded their efforts be discussed in an environment that was both supportive and critical.

As participants verbalized their experiences through the audio conferencing, computer networking, journal entries, and written articles, they developed a language to describe themselves and the contexts in which they worked. They also developed a growing sense of selfhood and their relation to the reality surrounding them. By sharing their thoughts and experiences with others, participants both reinforced their own point of view and embraced the ideas of others.

When asked what were the most helpful aspects of the networking opportunities participants responded:

- the ability to talk with other teachers, to ask questions, and to hear the problem-solving strategies
- making contacts and having the opportunity to share my experiences with those going through and dealing with the same issues
- being able to talk to people from other countries about their research
- hearing the teacher's voice
- exchanging views, sharing ideas, gaining perspective
- sharing a love of learning with others; feeling the excitement and dedication to providing the best possible learning situation for children

The networking opportunities provided through this project promoted self-disclosure and self-exploration. The ensuing dialogue, both internal and with others, was a constant and articulate reflection of self and reality. It was both a mirror and a window. At times participants could look through the window at a different educational environment and select those aspects deemed to be helpful. At other times participants could look into a mirror and be somewhat self-indulgent: "Hey! What I'm doing works well compared to what I see out there through the window!" or more reflective: "Perhaps there are some aspects of my classroom practice I should change."

Safe Simulation

Hargreaves warns his readers about the potential threat society faces through the permeation of technologically generated images. He suggests that "where people are surrounded by a plethora of images, this can create dramatic spectacles but also moral and political superficiality: aesthetic attractiveness, but also ethical emptiness."

Participants in this project did establish multiple opportunities for safe simulation. Their research projects were individual efforts to test out personal theory in practice. They brought these research efforts forward in a variety of mediums for public scrutiny. Sometimes the images were projected in print, sometimes through telephone lines, and sometimes through computer technology.

Participants generated a variety of images based on their own professional expertise and experience. Through personal reflection and collective dialogue project, participants created safe simulations for classroom practice. In Schrage's terms they created a shared place to learn collaboratively.

> Collaboration is the process of *shared creation*: two or more individuals with complementary skills interacting to create a shared understanding that none had previously possessed or could have come to on their own. (Schrage, 1990)

Real innovation, he believes, will come from the social matrix. It is collaboration — whether it be in person, in print, or electronically generated — not communication, that will ultimately have the greatest impact on the future. I believe when we are truly collaborative in our way of operating, we are creating safe simulations for consideration and possible action. We are, in fact, shaping the future in our collective imaginations.

Participants, through their networking, had many opportunities to discuss their ideas with colleagues prior to actually initiating classroom and school programs. These discussions created, in a sense, safe simulations. With adaptation, many of these simulations became effective realities. A principal describing his three-member staff action research team commented: "I saw staff deeply and powerfully extend themselves emotionally, physically, and intellectually for the project and the students it served."

Compression of Time and Space

Our world is virtually instantaneous. With fax machines, computers, and mobile phones, communication is possible almost anywhere, anytime, and with anyone. The world can be in our living room or on our computer screen as we choose.

Project participants recognize this compression of time and space as both a blessing and a curse. On one hand, they could access information and exchange ideas regardless of location or time. On the other hand, personal reflection, by its very nature, is a slow and often circuitous activity. Participants needed time and space to think and to discuss. Balancing these conflicting images of their professional world presented an ongoing challenge to all project participants.

This compression of time and space raises some interesting issues related to the working lives of educators. How will educators cope with increasingly available communication possibilities? Some will argue that this will add to teacher workload. Others will say that effective use will decrease teacher workload. Will technology facilitate the employees in public education becoming "electronic doormats" available to anyone, anytime?

Conclusion

I should like to highlight one project activity through which a group of teacher participants illustrate postmodern thinking and behaviours. The teacher describes the activity this way:

> The action research team of King George Public School met with Dr. Steve Chris via teleconference on November 14 [The Paradox of Globalization] to discuss the topic "focus groups." We had been wondering about using a focus group as part of our data gathering for our project related to building better home-school partnerships, but our ideas were vague [Dead Certainties]. Through our discussion with Steve, we were able to decide on how our first focus group of 7 or 8 parents will be formed and what will be its focus question. We also established that the meetings will be conducted using the "nominal group strategy" with which one of our team members has had experience. Steve will send us additional material on this topic. We will also be holding similar meetings with groups of teachers and students [The Moving Mosaic]. We all felt involving parents, teachers, and students in this way is a vital aspect of our goal enhancing partnerships [Safe Simulation]. We look forward to receiving valuable data regarding current perceptions on how well the home and school work together now and how we might change in the future [The Boundless Self]. Based on another suggestion from Steve, we will also create a small parent steering committee to evaluate our project as we proceed [Flexible Economies]. (Campbell, 1996)

Why was the notion of action research so readily embraced by project participants? Engaging in the action research process provided participants with a systematic way to improve personal practice. It made sense and brought sense to their professional world.

This project was profoundly empowering for most participants. There are many ethical, moral, social, philosophical, and instructional issues and questions to consider as we continue. Does computer conferencing assist self-disclosure and self-exploration? Does communication through technology facilitate self-indulgence or over-statements of reality? How will the profession deal with educators who won't or can't integrate technology into their professional experience? How will educators receive training and support as they learn to use technology for professional networking? Do collaborative efforts create safe simulations that translate into more effective classroom realities? Is teacher growth through action research and professional networking correlated with student growth? What are the characteristics inherent to effective networks?

Engaging in the action research process provided participants with a systematic way to improve personal practice. It made sense and brought sense to their professional world.

Action research and professional networking reflect the reality of the postmodern world in which educators function. The participants in the OPSTF-sponsored Innovation Fund Project consciously made choices about how they would function in their always demanding and often chaotic professional environment. Action research and professional networking helped them not only survive but also thrive in their roles as teachers, principals, and superintendents.

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Lessons from TVOntario

New Perspectives on Professional Development

By HELEN COLTRINARI

Manager, Education Community
Distance Learning Division, TVOntario

Much has been said and written about preparing our students for the 21st century. But what about their teachers? Teacher education and student learning opportunities form tightly woven threads in the tapestry of lifelong learning.

Since its beginnings as the Ontario Educational Communications Authority (the CRTC still grants the license to this authority) in a small office within the Ministry of Education, TVOntario has been involved with teacher professional development, curriculum programming for teacher use with students, and technology (TV, video, CD-ROM, to name a few) for educational purposes. Often imitated by US educational broadcasters, TVO has consistently led the field in instructional design formats and educational content in technology.

PD Workshops

The two branches of TVOntario — TVO: English Programming Services and TFO: French Programming Services — have been delivering teacher-training services in a variety of ways over the past 27 years, from workshops, courses, and conferences to the more recent delivery of teleconferences and Internet use. Often these services were topic specific, such as multi-year projects in AIDS Awareness, Substance Abuse Prevention, French as a Second Language, or Science is Happening Here. Teams of TVO-trained workshop leaders offered face-to-face training for teachers on topics such as classroom strategies, teaching methodologies, cross-curricular subject integration, and television utilization. Some will remember the days of the TRT system — a province-wide initiative with a TVO-trained "Television Resource Teacher" in every school. These TRT's were supported by workshops, conferences, newsletters, and TVO staff back at the office. TVO successfully built up a cadre of trained workshop specialists, course designers, and lead teachers who integrated the technology of television and, more recently, the computer into their workshops.

In recent years the funding for all of these projects became scarce and the in-house funding needed to maintain the workshop specialists network and the TRT system became even scarcer. The scene across the province, from school boards to faculties of education, was changing as well. Provincial government grants were being slashed for courses that for years had been taken for granted. Creative solutions were necessary as we realized that all of us would be operating in a new paradigm. It was time to implement a new way of delivering teacher training as we witnessed the reduction of professional development days and the disappearance of staff development positions.

> The most important understanding is that the needs of the learner must drive the choice of mode of delivery. Technology must be seen as a means to help the learning happen.

Changing Models of PD Delivery

In the 1950s, Edward R. Morrow said, "Television is the world's largest classroom." If this were truly the case, then the television, a familiar technology in the '90s, and found in almost every household and school, could be used as an instrument for instruction; " ... otherwise it is merely lights and wires in a box" to finish the Morrow quote.

Over the years, and through all of the initiatives, the TVO education team learned a great deal about delivering professional development opportunities for teachers and the use of technology:

- the one-shot workshop was effective for creating awareness but the transfer of skills was limited; "multi-phase" sessions produced longer-lasting results
- the old Chinese proverb "I do and I understand" became paramount to all training sessions; hands-on approaches were the most energizing and having the teachers "do" the activities had some guarantee of transfer to classroom practice
- the "train-the-trainer" model was most effective for first and second generations only; the third generation often felt that the other two had received all the perquisites and therefore were reluctant to commit
- inclusion of administrators in the training was key to their understanding of what the teachers had just learned and were attempting to implement in the classroom
- learning with technology had to be mediated; a television or a computer in the classroom did not ensure that learning would occur or that the technology would be used effectively, or at all
- learning using technology implied an investment of time and learning curves varied tremendously from individual to individual
- media literacy (for all media) was vital for all teachers and students to understand and master, especially in the age of burgeoning multiple media products

DLD and PDTV

In 1991, the Distance Learning Division (DLD) of TVO was formed and with this new department came many new mandates, not the least of which was to find and pilot new ways of delivering professional development to teachers at their place of work across the province. The evolution of ideas was both challenging and exciting and eventually became a production strand called PDTV: Professional Development Television for Teachers.

We knew that we could not embark

on such a venture alone. From the beginning of DLD, partnerships were sought and formed with school boards, teacher federations, faculties of education, and subject associations.

Behind the PDTV product was a philosophy that embraced the necessity of meeting the learners' needs. A continent-wide needs assessment told us that there was no perfect time to deliver the live, interactive programming, but the time slot that received the most votes was 4:00 PM to 6:00 PM EST. We piloted during these hours with rebroadcasts during the weekend DLD broadcast schedule.

Other needs emerged as well. Teachers wanted to look into classrooms to observe their colleagues teaching; therefore, we used real teachers in real classrooms and the third eye of the camera captured the action. The educators surveyed indicated that they wanted easily reproducible activities; hence, the on-air teachers demonstrated concrete suggestions and the accompanying teacher's guides contain extension activities, additional activities, and references.

In addition, teachers told us that interaction was necessary; thus, we opened the phone lines and accepted both calls and faxes. Given that our TVO Online computer-conferencing system was up and running, we decided to experiment with several Internet components: a registration-driven list-serve, e-mail, a web site, and conferencing to extend the learning through collegial sharing. The response in this domain was limited in our first year, but we were there and waiting for the activity. Science, literacy (language arts and media), and mathematics at the elementary level were the most frequently cited subject areas in need of innovative strategies and examples of the use of technology. So we started there.

We made a conscious decision to look at the teachers themselves as learners, not just as end-users of a curriculum product. The new programs, therefore, were mindful of the principles of adult learning and respectful of the teachers' prior knowledge and experiences.

Driven by these needs, we began the instructional design of the programs. Advisory groups were formed from among our partners in the larger education community. They recommended model teachers and suggested the innovative strategies which we translated into teleconferences.

The programs fell into three strands with a clearly enunciated rationale: deliver to educators, through new formats, the opportunity for professional growth at a distance. The programs in the first two strands were live, interactive teleconferences; each strand was supported with a print package.

Teaching For Results — Seven 90-minute teleworkshops designed to strengthen teacher skills in a variety of subject areas, to model effective television utilization strategies and to offer innovative ideas and activities.

Making Connections — Three series of four linked 60-minute programs designed to support the goals of Ontario's Common Curriculum. Hosted by an in-studio facilitator, guest teachers demonstrated specific classroom strategies through pretaped in-class video segments which were then discussed with on-air callers or over the Internet.

PDTV Specials — A variety of teleconferences or multi-part video series, co-produced with school boards, teacher federations, and other educational organizations to fill the need of their teachers/ members. These topical programs, designed to raise awareness and to encourage the sharing of information, introduced educators to leading-edge methodologies.

The Results

After one year of delivering PDTV, we have learned the many advantages and some of the limitations of distance delivery of professional development programming. As a follow-up, a random sampling of teachers, administrators, and faculty of education staff were surveyed for their reactions to the concept and content of PDTV programming. Their reactions will help the planning necessary for the next generation of teacher professional development products and services. Some generalizations can be made from our findings:

Equity of Access — Since almost everyone has a television, a VCR, and a telephone these technologies should be relatively popular for the distance delivery of PD events, but few schools had steerable satellite dishes to receive the signal; even fewer were ready to risk the Internet.

Congruence of Message — The same message, delivered by knowledgeable people to very wide audiences, can be a powerful, money- and time-saving venture. Through videocassette after-use, the PDTV program content can be discussed in a variety of settings from small groups at a school to large groups at a board level.

"Reach" of Participants — We were able to reach over 10 thousand viewers per teleconference.

Immediacy of "Live" Show — Though participants had to be encouraged to call in and teachers were still reluctant to reach us via the Internet, those who succeeded in reaching us had their questions answered immediately by the experts. This sharing and reflection was cited by many as one of the "more interesting features" of the productions. (Note: for us, interaction had two meanings — from the sites to the on-air teachers and interaction at the sites, among the participants. All of the programs were designed to include examples of both of these types of interaction. Follow-up interaction on the Internet was limited by lack of numbers.)

Impact of Visual Message — Teachers surveyed appreciated watching other teachers in action and then having these same teachers deconstruct their activities and interactions with the students. The administrators and faculty of education staff appreciated the modelling that occurred and the power of the medium of television to deliver the message.

And the Future?

The exploration of innovative strategies will continue. At the time of writing, TVO's Distance Learning Division is exploring and experimenting with creative uses of multiple media for the purposes of professional development and curriculum delivery. The most important understanding is that the needs of the learner must drive the choice of mode of delivery. Technology must be seen as a means to help the learning happen. Sometimes print and video provide the most efficient solutions. In some cases, computer software, CD-ROM, and the Internet make the most sense. Whatever the combination, the technology is the tool; the learners themselves are the centre of the professional development learning cycle.

THIS ISSUE

Chalkboard and print, still the mainstays of education technology in so many schools, are being superseded in others by a powerful combination of computers, electronic networks, and video. This issue explores these leading-edge technology-based school practices.

ISSN 0030-4433 03